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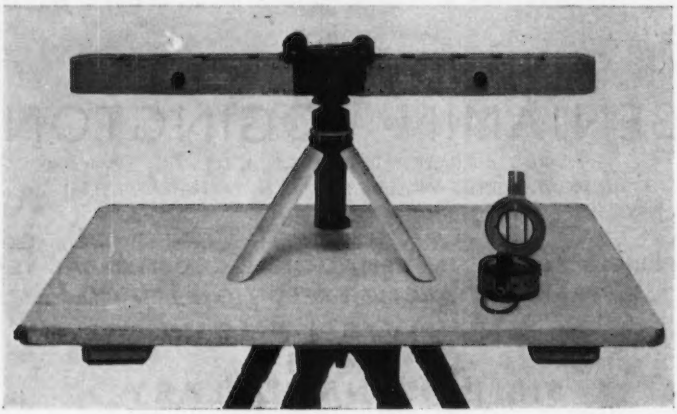

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Monday March 9 at 8.30 p.m.
THE CROSSING OF ANTARCTICA. *Film*

Monday March 23 at 5 p.m.
SOME ASPECTS OF AGRICULTURE AND SETTLEMENT IN PERU. *By C. T. Smith*

Monday April 6 at 6 p.m.
ADVENTURE ON. *Sound and colour film*

Monday April 13 at 8.30 p.m.
THE UNDERWATER EXPLORATION OF ANCIENT APOLLONIA. *By Lieutenant N. C. Flemming*

Monday April 27 at 5 p.m.
HISTORY IN A MAP. *By E. M. Yates*

Monday May 11 at 8.30 p.m.
EXPLORATIONS IN PATAGONIA. *By Eric Shipton*, C.B.E.

Monday May 25 at 5.30 p.m.
UNEARTHING ROMAN VERULAMIUM. *Colour films with commentary by Sheppard S. Frere*

Monday June 8 at 8.30 p.m.
THE ASCENT OF RAKAPOSHI. *By Captain M. E. B. Banks*, M.B.E.

Monday June 15 at 3 p.m.
ANNUAL GENERAL MEETING

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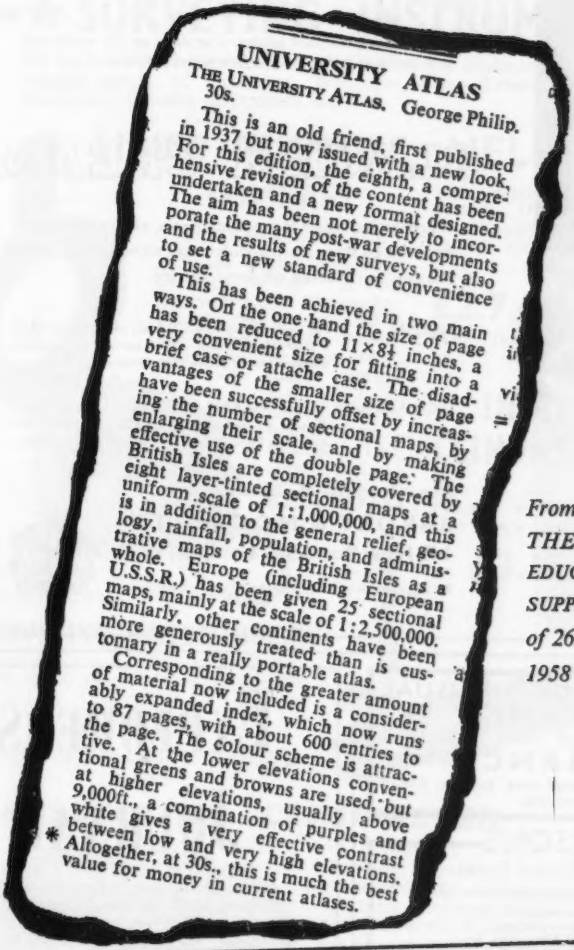

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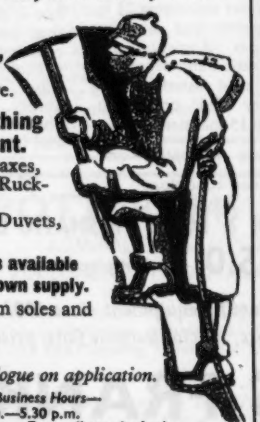

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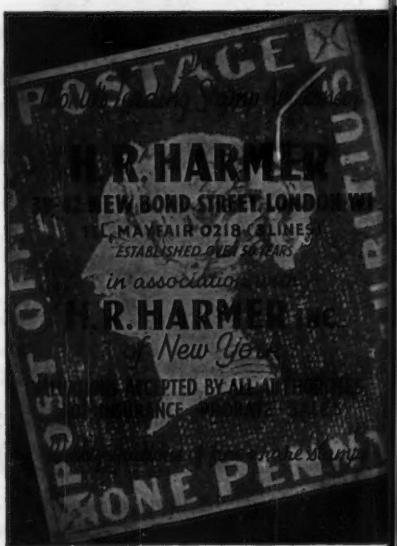

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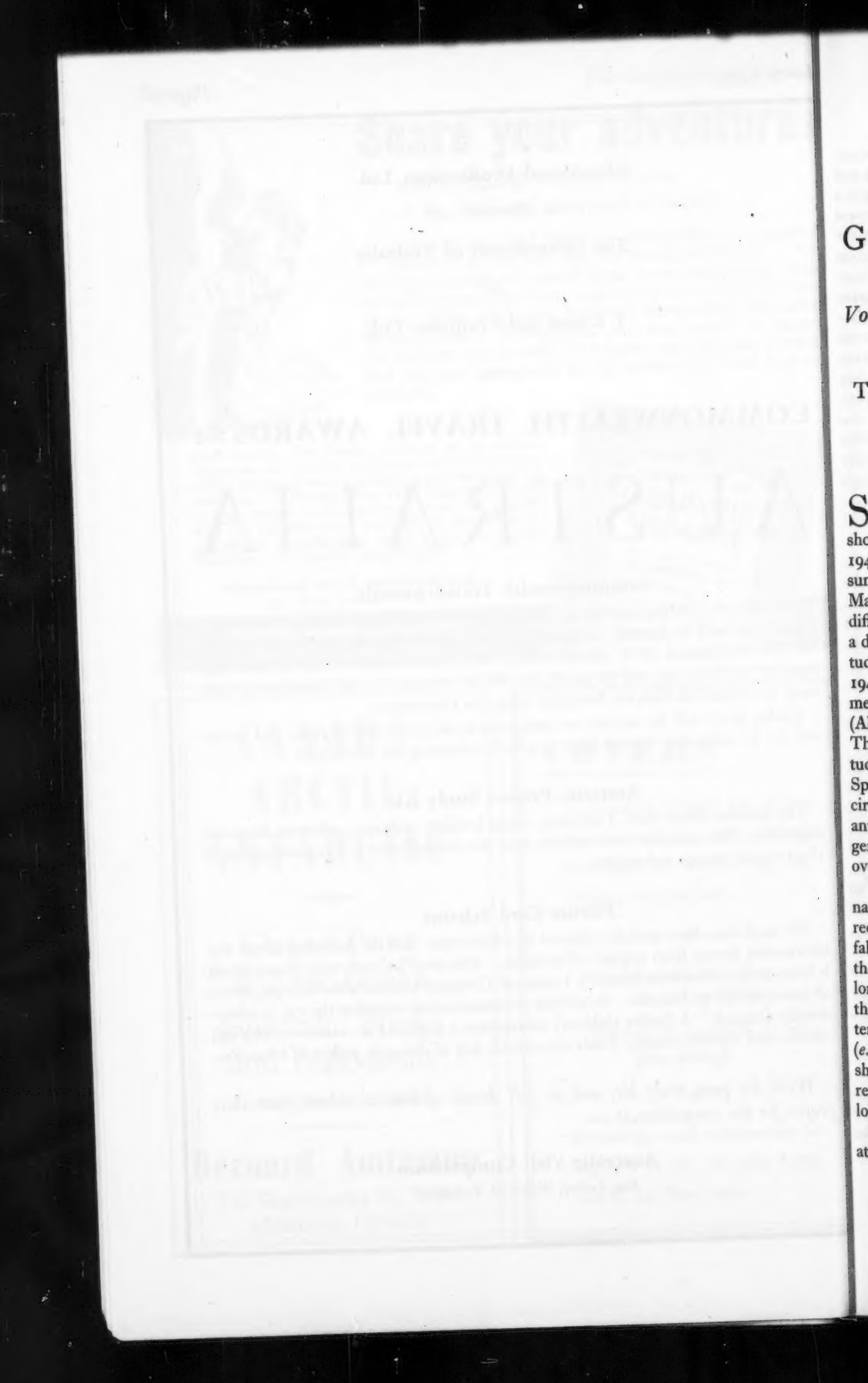

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The
GEOGRAPHICAL JOURNAL

Vol CXXV Part 1 *March 1959*

THE INFLUENCE OF CLIMATIC CHANGES ON ANIMALS AND PLANTS

D. J. CRISP

SINCE THE MIDDLE of the eighteenth century the climate of northern Europe has undergone a change. Several series of temperature records from different places show the same trend towards a more maritime climate (Ångstrom, 1939; Manley, 1946; Ahlmann, 1949a). Winter temperatures have risen and the difference between summer and winter extremes has been reduced. This effect is clearly seen in Manley's account of the secular variation in running means of temperature for different months in Lancashire, where the January and December values alone show a definite rise. The rise in temperature has been more pronounced at higher latitudes. Thus whilst the rise in mean-annual temperature between about 1870 and 1940 has been only a fraction of a degree centigrade in Britain (Manley, 1946), mean annual temperatures have increased by nearly one degree in Stockholm (Ahlmann, 1949a) and by nearly two degrees in northern Finland (Keränen, 1944). The rise in winter temperatures shows an even more pronounced trend with latitude, the increment amounting to four or five degrees in west Greenland and Spitsbergen (see Rubinstein, 1946; Hesselberg and Birkeland, 1940–4). The greater circulation of warm air into these northern latitudes has been accompanied by the anticipated increase in precipitation. During this same period there has been a general decrease in precipitation and a slight lowering of mean annual temperature over large land masses in lower latitudes (Lysgaard, 1948, 1949).

These changes have left their mark on the great natural registers of climate, namely the mountain glaciers, the polar ice and the inland seas. Glaciers advance or recede in response to the difference between their rate of accumulation from snowfall and their rate of melting in the warmer part of the year. Their size depends, therefore, both upon annual temperature and on precipitation integrated over a very long period. It is well known that a number of glaciers in northern Europe reached their maximum extent some 200 years ago and have since receded at a rate which has tended to increase in recent years (see Ahlmann, 1949b). Photographs of glaciers (*e.g.* Ahlmann, 1949a) taken from the same place at a time lapse of several decades show how dramatically this shrinkage has taken place. Since precipitation in these regions has, if anything, increased, the glacial recession must be entirely due to the longer and warmer melting season.

The temperature of the Arctic Sea has risen, probably as a result of increasing atmospheric circulation causing an intensification of the North Atlantic drift (Smed,

1949). The rise in salt content of the Arctic Sea suggests that there is greater penetration of warmer water into it. There is some evidence that this warming has led to a thinning of the ice cover. At the end of the last century Nansen made a forced passage across the Arctic Sea in the *Fram* and estimated the average thickness of the ice in 1893–6 to be 365 cms. In 1937–40 the Russians in the ice breaker *Sedov* made a comparable series of measurements and found that the mean thickness was only 218 cms. Whereas Nansen found a layer of water of sub-zero temperature to a depth of 200–250 m., by 1935 the thickness of this layer was found by Russian workers to have been reduced to one-half or one-third of its former value (Schokolsky, 1936). A similar trend is evident in the records of the Leningrad Arctic Institute which show that the extent of drift ice began to diminish in the Barents and Kara Seas in 1920, and a substantial reduction in the area covered by ice has since taken place. The icing over of the Baltic has also diminished (Jurva, 1952). In low latitudes both glaciers and inland seas have diminished on account of the reduced precipitation. For example, lakes and glaciers in East Africa are rapidly diminishing, the Caspian Sea and the Great Salt Lake are evaporating more rapidly than they are being replenished (see Tannehill, 1947). These changes, though not immediately relevant to conditions in northern Europe, should not be overlooked since they may have influenced the large-scale movements of some terrestrial species.

Since the distribution of many animals and plants can be related broadly to climate, the recent climatic change should have led to a corresponding change in the distributions of many living organisms parallelling its effect on the physical elements. There is, however, an important difference. The complexity and the many different ways of life of living creatures make them sensitive to a great variety of environmental influences, among which must be included their effects upon one another. They feed on one another, parasitize one another and so cause disease, and compete with one another for food. These interrelationships may easily obscure the direct influence of the physical environment; notably that of temperature, humidity and rainfall.

Therefore, whereas it is easy to understand how climate influences the physical elements, the relationship between climatic change and its ultimate effect on plant and animal life may be so complex that the train of cause and effect can be traced only with great difficulty. For example Mikola (1952) found that pine and spruce in Finland did not grow any faster during the period of high temperatures and longer growing seasons of the nineteen thirties than during the period 1910–30. This he attributed to the damage caused by noxious insects which were known to have increased during this period of mild winters. Furthermore the abundance of many animals fluctuates widely from time to time and often in cycles (Elton, 1927, 1942) for reasons that are not fully understood. These complications make it difficult to relate observed changes in the abundance of animals and plants to secular changes in climate with conviction, unless it can be shown independently that the climate influences directly the growth, mortality, fecundity or habits of the species.

The statistical approach is also possible. Let us suppose that a number of species have undergone similar changes in distribution, and that the great majority of these changes, both in direction and in magnitude, are of the kind that would be expected from the extent of climatic amelioration. Then, even in the absence of detailed evidence of cause and effect, it would nevertheless be reasonable to deduce that the climate was the primary influence, since no other common factor would be likely

to have influenced them all simultaneously. On such grounds there can be little doubt of the importance of climate in causing biological changes. Whether one considers a geographical area such as Finland where broad ecological studies have been pursued over a long period, or whether one considers a particular group of animals, such as birds, which have been observed with special thoroughness, the statistical evidence is overwhelming.

Whether the problem is approached analytically or statistically there remains the formidable obstacle of ascertaining the biological facts. Some objective form of measurement or census is necessary to show that a change in abundance or in range

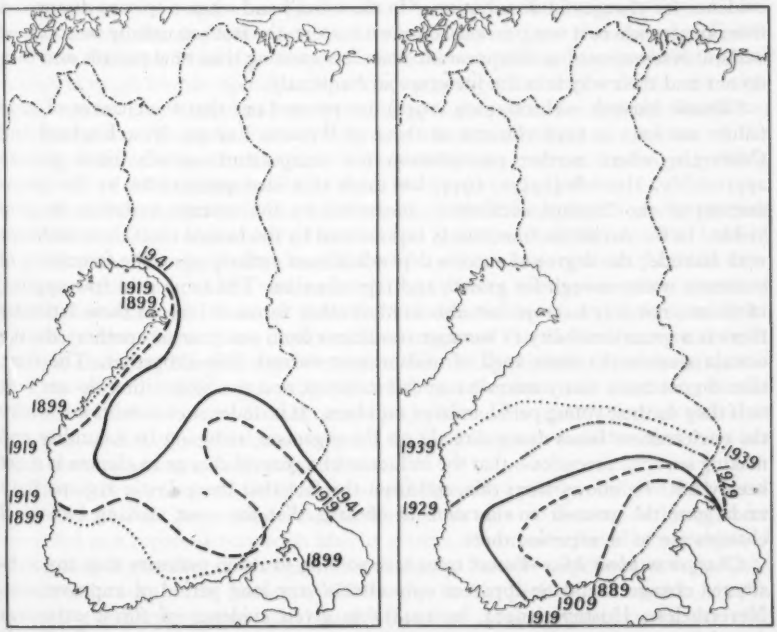


Fig. 1. Changes in the isopleths of the lapwing, Vanellus vanellus (*left*), *and the polecat*, Putorius putorius (*right*), *in Finland* (*from Kalela, 1947*). *Based on Figures 2 and 3 in Jesperson* (*1949*)

has taken place. A series of isopleths showing population changes from time to time, such as those shown in Figure 1, is the ideal, but unfortunately such detailed information has rarely been gathered in the past. Consequently, the only observations which are normally available are either chance records of biologists who were not primarily interested in this problem, or observations of sufficiently spectacular changes which have forced themselves on our attention. The biological evidence is therefore to be sought mainly among those groups of animals and plants which are the most keenly observed, such for example as forest trees, crop plants, game, fish and insects, all of which are of economic importance, and also among birds to which much popular interest is devoted because of their attractiveness.

When an animal or plant is found in a region hitherto believed to lie outside its normal range, it is not always possible to be sure that the new records imply an extended range for the species, even when they are confirmed by a number of observers. As soon as interest in a particular group or species is awakened, more observers tend to be enlisted in the search, so that the apparent extension of territory may be no more than an indication of the increased searching activity on the part of biologists. Few biologists in the past have realized the importance of establishing the absence of a species just outside its accepted limits by frequent and exhaustive searching. Though unrewarding at the time, the careful defining of faunistic boundaries in this way is essential if the records are to be used later as convincing evidence for changes in distribution. On the other hand when a species disappears from an area where it was previously known to exist, the fact can usually be accepted without reservation; but disappearances are less exciting than new records and they do not find their way into the literature so frequently.

Climatic hazards.—Huntington (1946) has pointed out that the chances of crop failure are least in such climates as those of Western Europe, New England and California, where neither precipitation nor temperature usually limit growth appreciably. Hustich (1947a, 1949) has made this idea quantitative by the introduction of the "hazard coefficient" measured by the average variation in crop yields. In the Arctic the uncertainty represented by the hazard coefficient increases with latitude; the degree of success depends almost entirely upon the frequency of summers warm enough for growth and reproduction. The same principle applies, of course, not only to crops but also to most other forms of life. In these latitudes there is a great variability in summer conditions from one year to another; during certain seasons the short spell of midsummer warmth fails altogether. The trees then do not fruit, many animals may fail to breed, and the birds either do not nest or if they do their young perish in large numbers. It is under such conditions, where the environment bears down directly on the organism, reducing its fecundity and making survival precarious, that the influence of a general change in climate is most keenly felt. It follows from this, and from the fact that these Arctic regions have undergone the greatest amelioration in climate, that the most striking biological changes are to be expected there.

Changes in plant life.—Forest trees take so long to reach maturity that any substantial change would be apparent only after a very long period of improvement. Nevertheless, Hustich (1947a, b, 1948) has given evidence of forest extension especially among the dispersed pines in the forest tundra in Lapland. E. Kalela (1952), however, believes that improved silviculture and other changes in forest management as well as climate may have been important. Photographs of the tree line of unspoilt natural forest, taken at an interval of thirty years by Nordhagen (1956) in the Norwegian National Park, show "that the period 1920–54 was a propitious one for the birch forests, the groves having become more closed, healthier and higher." The rise in the tree line was, however, quite small in extent.

The evidence of greater growth of trees in the Arctic is more definite. Brier (1948) demonstrated the correlation of high mean annual hemisphere pressures, which are usually accompanied by low temperatures, with low increments in girth in pine. During the present century Hustich (1947b, 1949) claims that the growth of pine (*P. silvestris*) in the Arctic has tended to increase, as also has the growth rate of trees in temperate latitudes (Jones, 1947), but in regions where precipitation limits growth, for example in Oregon, the growth rate has decreased. Mikola (1952), however, found only limited correlation between growth ring width and tempera-

ture, though his method of allowing for the regular change during normal growth may also have eliminated the trend due to long term amelioration. The earlier dates of leafing and blossoming and the later yellowing of a number of trees and shrubs are recorded by Erkamo (1952); these changes have certainly resulted in more frequent and extensive fruiting. Seed years were rare on the timber line between 1850 and 1917, but became frequent from 1917 to 1948 with many seedlings surviving. However, an apparent extension of seedlings is not absolutely reliable evidence of spreading of the forest, since they may fail to survive.

Of the plants which have extended, the most rapidly spreading were those whose seeds are wind-dispersed, such as *Typha latifolia* and *T. angustifolia*, *Hypericum hirsutum* and the maple *Acer platanoides*. Plants dispersed by water (*e.g. Ricciocarpus natans*, *Riccia fluitans* and *Carex rhynchophysa*) have also spread well into northern Finland, while *Poa compressus* and *Bidens radiatus* have probably spread mainly through human agencies. Hustich (1949, 1952) has attributed the extension of successful rye, barley and oat growing to higher latitudes and the increasing yields of these cereals in Finland largely to climatic amelioration, because of the good correlation of yield with positive temperature anomaly, and a longer growing season. New cold resistant varieties must however have helped.

Increased precipitation in the more oceanic parts of Scandinavia, accompanying the rise in average temperature, has also had a noticeable influence. The level of ground water has risen with the melting of ice from bog mounds. Lichens have disappeared from boulders, and water plants, such as *Calamagrostis*, have appeared where previously rare or absent. South of Scandinavia there is less definite evidence of change in the flora. Some observers have suggested that in the Alps, for example, the tree limits are being lowered because of decreasing rainfall (Capello, 1941), and that in central Europe generally the continental species are increasing at the expense of Atlantic ones (Rosenkranz, 1951). Braun-Blanquet (1955) on the other hand, as a result of personal knowledge of the Piz Languard, considers that there has been an enrichment of high Alpine flora.

Birds.—Few groups of animals are so closely and regularly observed and documented as birds. Any easily recognizable species new to an area is likely to be recorded and reported very soon after it arrives. Summaries have been published by leading authorities in Hungary (Keve, 1948), Scandinavia (Loppenthin, 1948; Lundevall, 1953), the Faroes (Williamson, 1948), Finland (O. Kalela, 1946), Iceland (Gudhmundsson, 1951) and Greenland (Salomonsen, 1948), and the problem has been reviewed more generally by Fisher (1954) and Jespersen (1949). As might be expected, there are many records of birds which have entered new territory, or have increased in abundance. The majority of such birds have evidently spread from more southerly latitudes (see Salomonsen, 1948). Fewer birds have been observed to be disappearing or diminishing, but the majority of these have centres of distribution to the north of the area in question. Thus the trend of the majority of species has been to shift northward in accordance with milder climates of northern latitudes. Bearing in mind that there are fewer species of birds in high latitudes the changes observed in bird populations are very significant in those countries which extend into the Arctic circle, such as Greenland, Iceland, Scandinavia and Finland. In Finland some permanently resident birds such as the partridge, to which severe snow is inimical (Siivonen, 1952), the tawny owl, and many species of tit have extended northwards. A number of migratory birds have increased; some, including familiar birds such as the lapwing, blackbird and song thrush, leave Finland only for the short winter period and fly no further than

southern Europe. O. Kalela (1952) relates the increase in number of these birds in Finland with the occurrence of warmer springs. Other migrants travel further south and east, leaving their northern haunts in autumn and returning in late summer. Many of these birds have extended their summer migrations in a westerly rather than a northerly direction. The red-flanked bluetail which at one time rarely extended beyond the Urals, the red-breasted flycatcher which over-winters in India, and the greenish warbler which winters in the Far East are examples of distant migrants which are now found in the North Baltic area (Moreau, 1952). Their increase has been attributed to the rise in summer temperature that permits breeding further north, but it is difficult to believe that this is the whole explanation, for the temperature anomaly has been less marked in summer than in the other seasons. Moreover there are examples of other migrations in a north-westerly direction to central and western Europe where there has been no rise in summer temperature at all (see p. 7). Lastly, many of the water fowl which have extended into the shallow lakes of Scandinavia have come from the Steppe districts of Asia which are now tending to dry up (O. Kalela, 1952). It is possible therefore that climatic changes outside the far north have played a part in the entry of some of the migratory birds into Scandinavia and Finland.

Changes similar to those in Scandinavia have occurred in Iceland and Greenland. In Greenland, the white-fronted goose population has increased and spread northwards, the Canada goose, fieldfare and long-billed marsh wren have commenced to breed. Other birds have changed their habits; there are more occasional visitors, the kittiwakes leave later in the season, and some species, like the mallard and long-tailed duck, which were summer visitors now remain throughout the year. In Iceland, the starling, black-headed gull, herring gull and the tufted duck breed regularly and even the swallow nests occasionally.

With the amelioration of the winters, a few boreal species have been pushed so far to the north that they have become less frequent. The willow grouse, rock ptarmigan, brambling and Siberian tit have decreased in Finland, and the long-tailed duck and little auk in Iceland. It would appear at first sight that the climate has become too warm for them. But it is difficult to see how the rise of a few degrees in climate could in itself be anything but beneficial, except perhaps for such birds as the willow grouse, rock ptarmigan and long-tailed duck which may be more conspicuous to predators on ground bare of snow. A more likely explanation for the other species is that the northward advance of southern birds has driven out the boreal forms which find it difficult to compete successfully. Sometimes a southern species may be so close ecologically to its boreal counterpart that the two cannot exist together, except over a fairly narrow part of their respective territories, without the one dominating the other. Merikallio (1951) studied the zone in which the chaffinch and brambling coexisted in roughly equal numbers. He found that between the period 1910–29 and 1941–9 the zone had shifted between 100 and 350 kilometres further north. As a result, the population of the more boreal species, the brambling, had diminished, since it was unable to survive beyond the Arctic treeless zone. A similar situation exists in the relation between the tufted and long-tailed duck, which will both breed in fresh or brackish lakes near the sea and enjoy a similar diet of winkles, bivalves and insects. The long-tailed duck was at one time found in Shetland, and bred in Orkney until 1926. Once it was nearly the commonest duck in Iceland, but it has apparently been ousted by the tufted duck from the coastal marshes and has found refuge in tundras of the higher central plateau (Scott *et al.*, 1953). In Britain the hooded crow has been increasingly supplanted by the common

crow and the rather rare Arctic tern has become even scarcer in relation to the common tern (Fisher, 1954).

The reduction in numbers of the little auk, however, provides a clear example of how an improving climate may have a directly adverse effect on a species. This tiny bird nests like other auks on rocky cliffs but is confined to the high Arctic, Iceland being its southern limit (Fig. 2). It feeds on small crustacea such as mysids, which are very plentiful in the surface water near the sea-ice front. As the ice front retreated northwards the birds in the Icelandic colonies had to fly ever longer distances for food, and the colonies were thereby gradually deserted. At Grunsey there were vast numbers in the nineteenth century; by 1903 less than 200 pairs could be counted, and by 1951 only about twenty birds remained (Gudhmundsson, 1951).

There are certain spectacular changes in bird distribution which should also be considered. The most remarkable is that of the collared turtle dove which has spread steadily from Asia Minor into Europe over a long period (Fisher, 1953). It reached Constantinople in the eighteenth century, and the Balkans by the beginning of the twentieth. In about 1930 it began a rapid dissemination into central and northern Europe, individuals reaching even Britain and Finland (Fig. 3). Climatic amelioration as a cause of this spread seems to be ruled out; first because the spread began before the climate became milder, secondly because the climatic change took place outside its original territory in Asia Minor, and lastly because the magnitude of the biological change is too large in comparison with that of the climatic shift. Since it is a bird of towns and villages human factors rather than climate are likely to have been responsible (Keve 1944, Nicholson, 1952). Similar objections can be raised against regarding the expansion of the serin as being due to climatic change. This bird is known best in the shape of its yellow variety, the canary. Once confined to the Mediterranean it spread into the Carpathian basin and thence into the central European plain, France, and Scandinavia (Lundevall, 1953). Further south the Syrian woodpecker has extended in the same way into central Europe (Keve, 1948).

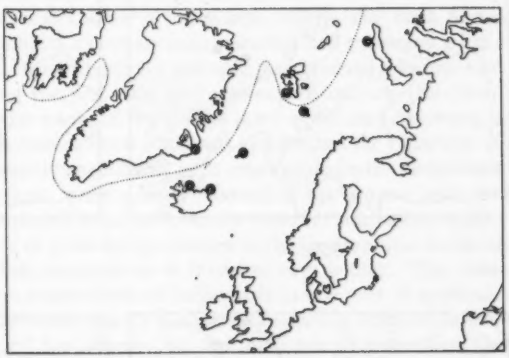


Fig. 2. Distribution of colonies of the little auk. Dotted line shows the approximate position of sea ice boundary

The fulmar illustrates a vast dissemination in a direction opposing the climatic shift. Originally a bird of the high Arctic, it first colonized the Faroes in about 1850, thence it spread to Shetland and Orkney, and more recently along the east and west sides of Britain to the south coast. Fisher (1952) considers that this extension was caused by a change in feeding habits due to the influence of man. Once a plankton feeder, the fulmar first took to eating offal discarded from whalers. Now it is the deep sea trawlers that maintain the supply of readily available food to the sea birds which flock round them. The change to a diet which is much easier to obtain has

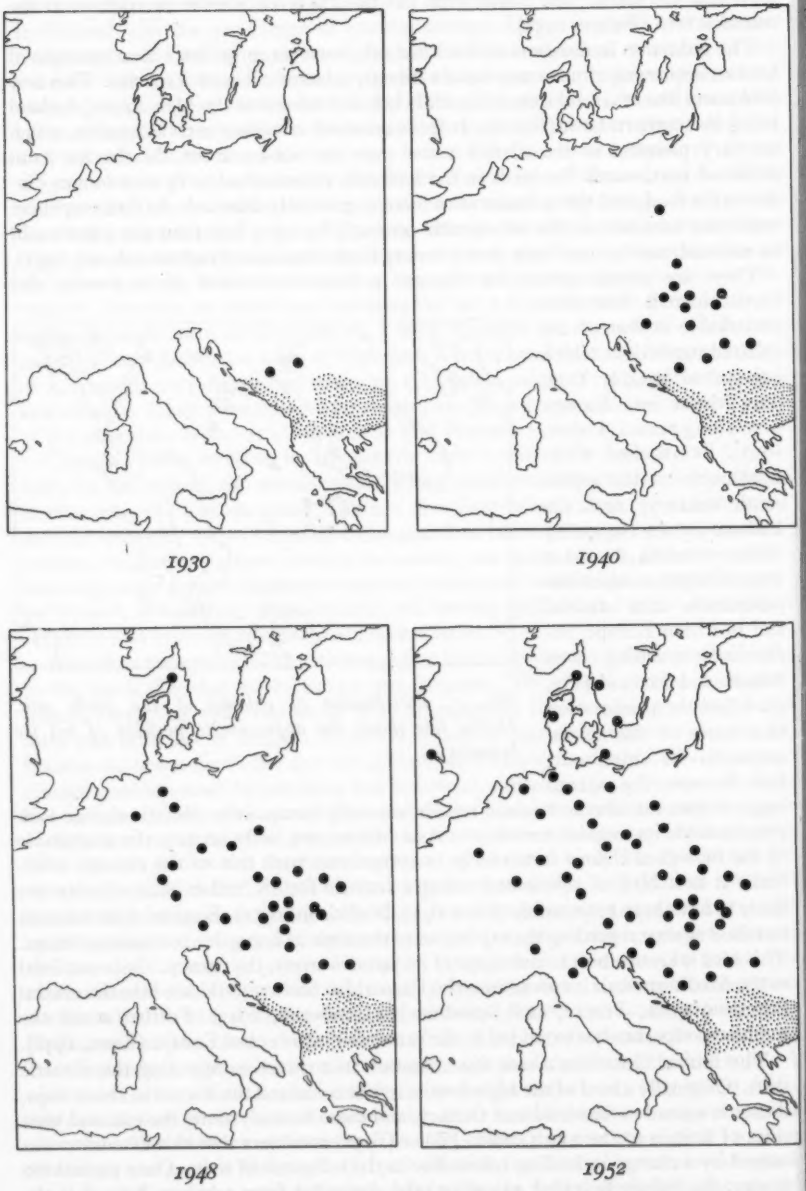


Fig. 3. Changes in the distribution of the collared turtle dove. Shaded area represents territory occupied prior to 1900; black dots indicate records. (*Based on Fisher, 1953*)

enabled the fulmar, in company with many other sea birds, to multiply more rapidly and to extend into more southerly waters, where in spring and summer the plankton is less rich than in the waters of the Arctic.

Mammals.—In Finland the mammal fauna can be divided into three main groups concentrated respectively in the fjeld and tundra zone, in the southern arable areas, and in the central forest. The northern and, more especially, the southern elements exist at the fringe of their natural distribution centres and are cut off from them by the White Sea and Gulf of Bothnia respectively. The forest animals, however, have faunal continuity with the great forests of Siberia. For this reason they have been less influenced by climatic fluctuations (Siivonen, 1952). Mammals of the southern group, such as the field hare, hedgehog and polecat, have spread northwards since the end of the last century until the thirties; during the early forties winters were more severe and a reversal was noticed (Siivonen, 1948). The roe deer has similarly re-established itself in southern Scandinavia (O. Kalela, 1952). The most Arctic elements of the fauna have suffered a corresponding decline, but recovered a little ground in the forties. The European lynx, for example, has gradually disappeared from southern Finland during the first part of the twentieth century (Siivonen, 1946). In all these examples the extent of the change is not great, and corresponds in magnitude with the shift in mean annual isotherms. In Iceland the reduction in ice formation on the coast in winter has probably been responsible for the diminished number of polar bear and walrus, while a large mammal of the warmer seas, the Caaing whale, is now more frequently taken in Icelandic waters (Fridriksson, 1949).

Insects.—The chief difficulty in considering changes in the geographical limits of insects is the tendency for their populations to fluctuate very widely. They may vary at one given locality from a sprinkling of individuals in one year to epidemic proportions in another. Furthermore, insects are not influenced in any simple way by temperature. Bierne (1947) has shown that the incidence of butterflies, for example, usually falls after mild winters and rises after severe ones. He attributes this to the mortality of small birds which are among the chief predators, and which are more seriously affected by cold than the hibernating pupae. On the other hand, in Arctic countries severe autumn or spring frosts, when there is no protective snow cover, can cause serious losses to pupae in shallow soil. A further complicating factor is the susceptibility of many insects to fungus attack in moist and windy seasons. Nevertheless a number of new species of butterflies are recorded as having entered southern Finland during the thirties, perhaps in response to warmer conditions. Those new to south-west Finland were generally species which hibernated as eggs or imagos, while those new to the south-east hibernated mainly as pupae (Nordman, 1952). There is also some evidence of an increase in plant bugs in recent years probably due to warmer autumns and prolonged growing periods, from which both the plants and the larvae sucking them have benefited.

Marine animals.—The temperature of the North Atlantic has shown a generally favourable trend since 1876 with the exception of a drop between 1900 and 1920. According to Smed (1949) sea areas west of Greenland reached a maximum temperature just prior to 1930, those just to the east of Greenland became warmer in the thirties and then became steady. In the eastern North Atlantic as in the land masses of north-west Europe there has been a steady rise. This rise has been greatest in northern waters and has been inappreciable to the south of the British Isles. Waters near the European mainland show a general rise with fluctuations corresponding with those of the adjacent land (Fig. 4). The biological consequences of changes in sea temperature are likely to be more definite than the corresponding

changes on land. On land there are many factors in addition to temperature which control distribution, such as light, humidity, rainfall, soil, and natural barriers like mountain and desert. The sea is by contrast very uniform; its chemical composition varies in a manner which might significantly influence organisms only in the neighbourhood of rivers or where upwelling brings more nutrient salts to the surface.

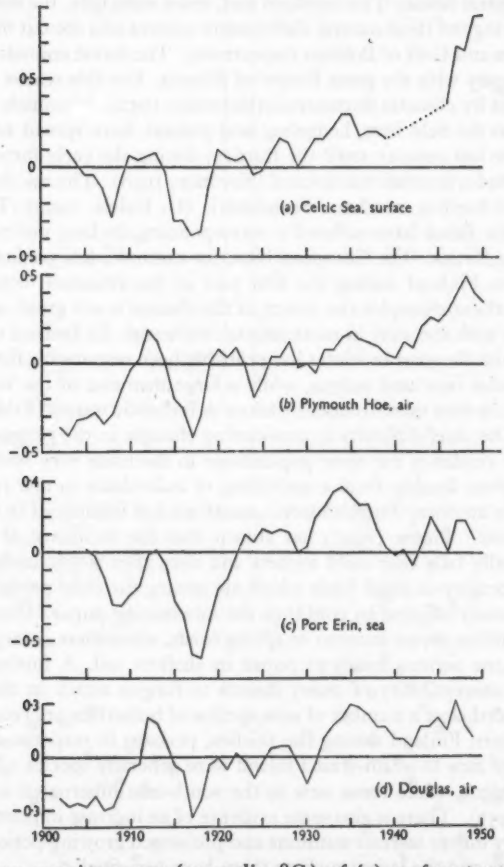


Fig. 4. Five-year running means (anomalies °C.) of (a) surface temperature of the Celtic Sea (International Council area P) 1903–39 and 1946–50; (b) air temperature at Plymouth Hoe, 1900–51; (c) surface sea temperature at Port Erin, Isle of Man, 1903–50; (d) the air temperature at Douglas, Isle of Man, 1900–50. (Southward and Crisp, 1954)

Consequently, temperature barriers would be expected to offer the main restriction to the spread of oceanic species. This, indeed, appears to be the case. It must, however, be borne in mind that water masses of different origin tend to maintain a characteristic temperature because of the high capacity of water for heat. As a result the boundaries of these different water masses often coincide with tempera-

ture differences. Fauna which are, in fact, associated with a particular water mass may therefore give the appearance of being distributed in relation to temperature. In so far as temperature is an important factor a northward displacement of the marine fauna during the last hundred years is to be expected.

Of greatest practical importance is the influence of sea temperature changes on the fisheries. Unfortunately the two fish of greatest economic value in the North Atlantic, the herring and the cod, are both strongly migratory. Moreover, their movements alter from one era to another, so that the successful fishing grounds change from time to time. Hitherto, these changes have defied adequate explanation in terms of environmental factors. The capricious behaviour of the herring is well known. In certain areas its incidence seems to be periodic. Periods of good fishing in the Norwegian Sea seem to alternate with periods of abundance in the Baltic. The southern limit of the Herring lies roughly at the western entrance to the English Channel. In the early thirties, fishery biologists at Plymouth noticed the disappearance of young herring from the plankton. The number of older fish then gradually dwindled until the herring ceased to attract east coast drifters. The change may have been caused by higher sea temperatures after 1930, or it may have been due to a change in the nutrient content of the water which is believed to have taken place at about the same time (Kemp, 1938). During the period of decline in the Channel herring fishery, the pilchard, a southern fish, has increased and spread, extending even to the North Sea on occasion (Storrow, 1947; Hodgson and Richardson, 1949; Cushing, 1957).

The cod fishery has also suffered unexpected fluctuations. There was good fishing off the Lofotens and in Arctic waters between 1870 and 1900, after which the fishery declined. From 1920 onwards the fishery has improved (Rollefsen, 1949). Recent studies of the hydrography of the Bear Island region show that the cod congregate where warmer Atlantic water meets the colder Arctic water, which apparently limits further migration. The influence of temperature on the cod is likely to be the cause of important changes in the Icelandic fishery. Up to 1903 the spawning grounds did not extend to the north of Iceland. The cod has now extended to waters of east Greenland where it now constitutes a separate population some 300 miles further north (Tåning, 1943, 1949; Halme, 1952).

Fishery biologists and those who finance them have realized that in order to understand fish and their habits it is necessary to survey many other marine organisms which may not be of economic value in themselves. A result of this enlightened policy has been the discovery of changes in the animals of the sea bottom, which demonstrate the influence of climatic change much more clearly than could be achieved by studying migratory fish. Towards the end of the last century, expeditions began to examine the bottom fauna of the oceans. Although the results of any one cruise in one sea area are usually too meagre to form the basis of a distribution map, the result of many may give a significant picture, especially if the animals known to prefer cold and those known to frequent warmer water are lumped together. Such animals are called "indicator species." Figure 5A shows the distribution of some of these indicator species near Spitsbergen based on all the records from 1878 to 1931. The adjacent map (5B) shows the results obtained from cruises since 1949. The area covered by warm water species now clearly extends some 200 to 250 miles further north into waters previously populated almost exclusively by Arctic forms (Blacker, 1957).

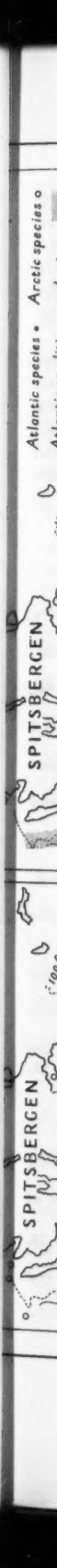
Changes in marine life have also been observed in the Baltic Sea, though here it is likely that salinity changes as well as the temperature rise have been responsible.

The salinity of the Baltic has been rising steadily, at least since 1930, probably as a result of greater inflow of salt water under the more frequent stress of westerly winds. The common jellyfish *Aurelia aurita* together with another floating organism *Fritillaria borealis* has been found further up the Gulf of Finland than ever before (Segerstrale, 1952), while sprats and young cod have been successfully fished at the entrance to the Gulf of Bothnia, so far as is known for the first time.

Both the sea bottom and the constantly shifting waters of the ocean are realms where exact faunistic studies are difficult and costly. The practical obstacles to the study of marine life are much fewer on the narrow strip of territory lying between the sea and the land, for the shores in most parts of the world are daily exposed to view. Moreover, the littoral animals and plants are for the most part restricted to this narrow band. They can, therefore, be surveyed in their entirety, and their boundaries within a small geographical area can accurately be mapped out in a relatively short time by a small number of biologists. Lastly, shore organisms are usually fixed or slow-moving, so that changes observed are likely to reflect changed conditions in the locality, and cannot represent changed habits or migrations.

Recently, Dr. Southward and I noticed that the barnacle population in South Devon had undergone a profound change. Here the common acorn barnacle *Balanus balanoides* is near the southern limit of its range and suffers the same kind of climatic hazard that befalls other creatures living in extreme conditions. In some years in our south-western waters it fails to produce a spatfall, and is temporarily displaced by its southern competitor *Chthamalus stellatus*. Such a change took place between 1935 and 1951 over much of the south-west of the British Isles, though subsequently *Balanus* has regained some ground (Southward and Crisp, 1954, 1956). The competition between these two creatures is probably related to their rate of feeding by grabbing and filtering particles from the sea; *B. balanoides* is the more efficient at lower temperatures and *Chthamalus* at higher (Southward, 1955). Consequently, in the warmer south-west, the latter is able to squeeze out the former by growing faster and producing more spat. In the same period there is some evidence of a corresponding increase in another warm water barnacle of the Channel coasts, *Balanus perforatus*, and of a warm water kelp *Laminaria ochraleuca* (Crisp and Southward, 1958). Certain southern seaweeds are believed to be spreading northward along the coast of Norway (Jarde, 1951). For many boreal species which, like *Balanus balanoides*, reach their most southerly limits on the Atlantic coast of France and north Spain, the climatic hazards are extreme, as they are to a lesser degree in south-west England. Fischer-Piette (1955) has been studying these areas closely in recent years, and has recorded violent fluctuations in the abundance of boreal organisms of all kinds—lichens, wracks, kelps, dog whelks and barnacles, though there is not as yet enough information to relate these changes closely with environmental factors. The seashore is likely to prove an ideal environment for the study of dynamic zoogeography.

The conclusions to be drawn from this review may now be summarized. Numerous changes have been observed in the distribution of animals and plants during the period of climatic improvement in Europe. Some, like the migration of the collared turtle dove, and the serin, are too widespread and prolonged to be attributed to climatic improvement; like the extension of the fulmar, these changes are probably due to causes acting independently of climate. The changes which can reasonably be accounted for by climatic amelioration are only of moderate extent



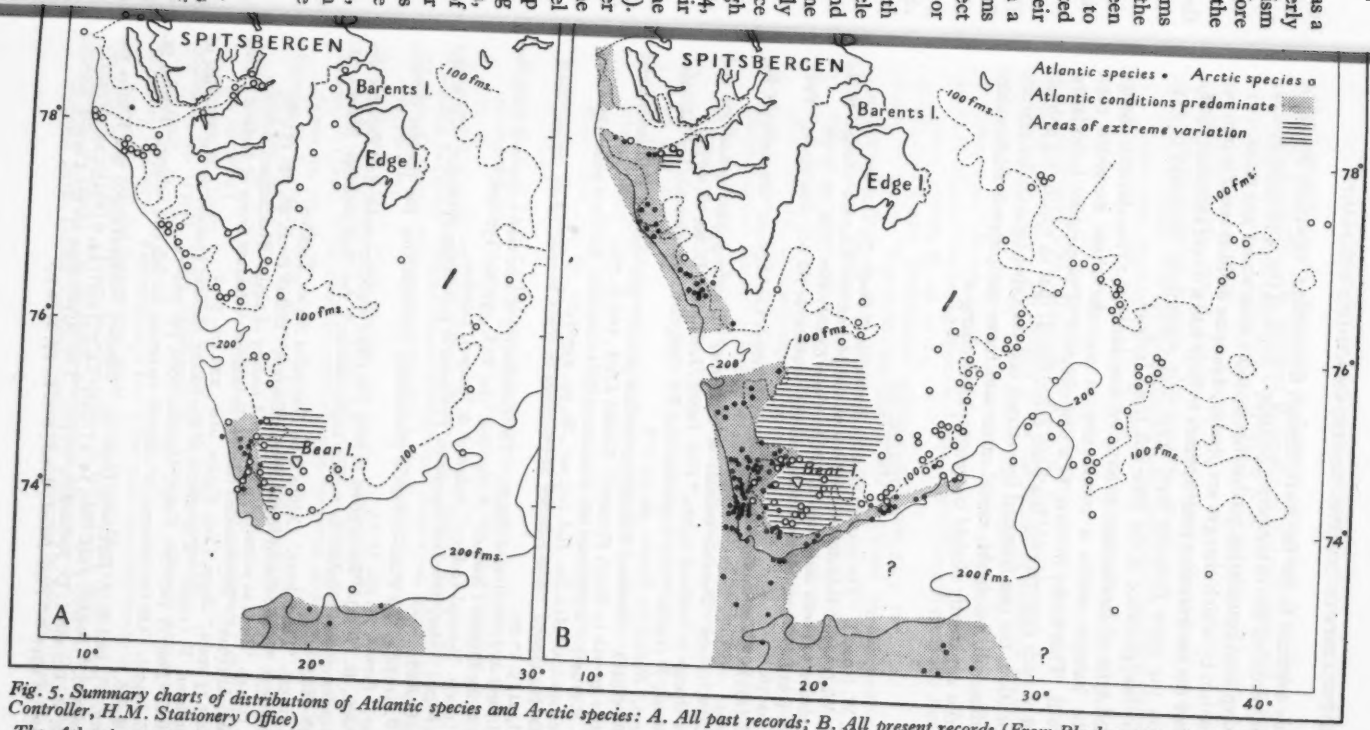


Fig. 5. Summary charts of distributions of Atlantic species and Arctic species: A. All past records; B. All present records (From Blacker, 1957, by permission of the Controller, H.M. Stationery Office)

The Atlantic species plotted are: Lithodes maia, Sabinea sarsi, Ceramaster granularis, Pseudarchaster parelii, Hippasteria phrygiana, Gorgonocephalus lamarcki *and* Geodia barretti.

The Arctic species are: Sclerocrangon ferox, Sabinea septemcarinata, Poliometra prolixa, Heliometra glacialis, Hymenaster pellucidus, Lophaster furcifer, Gorgonocephalus arcticus, G. eucnemis *and* Ophiopleura borealis.

The stippled areas indicate the bottom where Atlantic influence predominates. Latest samples show that Atlantic species now occur as far as 79°10′N. west of Spitsbergen. The hatched area covers places where conditions may vary from extreme Atlantic to extreme Arctic conditions (5°C. to −2°C). More samples are required from there and from the areas marked ?.

and are mainly confined to the far north, though fluctuations, especially in marine life, have been recorded also in temperate latitudes. None of the apparently genuine effects have displaced boundaries northwards by more than about 200 miles.

The mechanism by which changes are produced may be divided broadly into two groups. In one the environment itself appears to have had a direct influence, as for example upon the more frequent seed years and consequent extension of Artic plants, or the disappearance of the little auk from Iceland.

The second type of mechanism is more or less indirect. The climatic change influences the balance within a community of animals whose members react differently to it. This leads, in turn, to a displacement of population boundaries. The simplest of such systems only has been exemplified: that in which two animals live in competition, the one favoured by warmer and the other by a cooler climate. Further studies will, no doubt, reveal other and more complicated relationships which underlie apparently simple biogeographical changes.

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DISCUSSION

Evening Meeting, 20 February 1956

Before the paper the PRESIDENT (General Sir JAMES MARSHALL-CORNWALL) said: The lecture this evening is concerned with the changing climate of northern Europe. While climate does not suffer the same rapid changes as does weather, it is, nevertheless, subject to fluctuations. About a million years ago in the Pleistocene period the whole of northern Europe and North America were covered by an enormous ice sheet which advanced and receded four times with tremendous consequences for animal and vegetable life throughout the world. Geographers, therefore, are particularly interested in the subject of climatology; indeed, it is a field of study in which the meteorologist and the geographer must meet and work very closely together.

The changing climate in the North Atlantic and north Europe has been an interest of this Society since 1945 when some here may remember that we had in this hall an interesting lecture by the distinguished Swedish glaciologist, Professor Hans Ahlmann, on the recession of the northern glaciers and the connection of that shrinkage with climatic change. That subject was subsequently expanded in the first of our Research Memoirs under the title "Glaciological researches on the North Atlantic coasts." Our lecturer tonight is going to approach the subject from a biological aspect. Dr. Crisp is the Director of the Marine Biology Station of the University of Wales at Menai Bridge, Anglesey, and we shall listen with interest to what he has to tell us.

Dr. Crisp then delivered his lecture

The PRESIDENT: We invited to be with us tonight, Sir David Brunt, formerly professor of meteorology at the Imperial College of Science and Technology. Unfortunately Sir David has influenza, but we have another distinguished meteorologist

with us—Professor Gordon Manley, a past member of our Council and now professor of geography at Bedford College, University of London.

Professor MANLEY: I should like to congratulate Dr. Crisp on the way in which he has shown in compact form a remarkable amount of significant biological evidence, from the seas adjacent to our islands, of the effects of the recent climatic amelioration. Some authorities now suggest that it began about 1890, but certainly it became much more noticeable about 1925, as the Icelandic data show. It will be observed from the attached diagram (Fig. 6, below), drawn up from my table of English monthly mean temperatures (*Quart. J. Roy. Met. S.*, 79, 1953), that, making use of decadal running means for the four seasons, spring, summer and autumn all begin to rise from about 1930, that is with the completion of the decade centred about 1925. With regard to

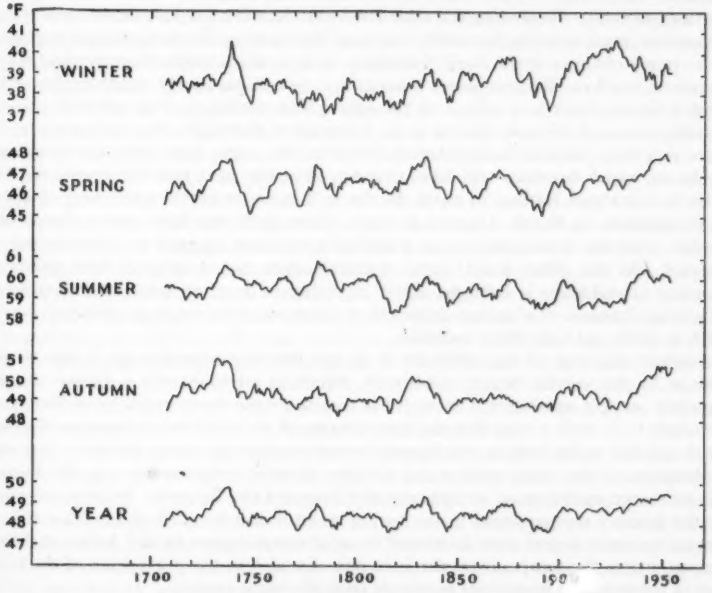


Figure 6

our summers the accordance with other records is quite evident, and can be recognized in eastern North America (*cf.* my diagram p. 201 in *Proc. Toronto Meteor. Conference, publ. by Roy. Met. S.*, 1954). Winters have become colder, but meanwhile the yearly mean temperature has steadily risen and I take it that the biological effect is most likely to be associated with this overall annual rise. Studies of this type, however, point to the existence of irregular fluctuations taking the form of rises or falls over periods of the order of two to three decades in length as the curves suggest. Hence it becomes noteworthy that several meteorologists have already suggested that the beginning of a downward trend can be observed about 1950. Dr. Crisp's evidence of a southward displacement of certain creatures, and a return of more northern types towards the south about 1951, is therefore especially interesting. We can certainly recognize, since then, a number of events such as the long cool spring of 1951, the extremely cold September of 1952, and the 1954–6 occurrence of three successive cold Februaries; in addition, the conspicuously cool summer of 1954. In spite of the exceptional warmth of July–August, 1955, it remains to be seen if the oncoming decade will not see the

continuance of this downward tendency. We are as yet only on the fringe of knowledge of these slight fluctuations and why they occur; it is possible that the extensive programme of observations during the International Geophysical Year will provide needed data, especially in regard to the vicissitudes of high-level atmospheric behaviour in a year which is expected to provide a sunspot maximum. That these changes may have great biological significance is apparent especially in relation to fisheries, and Dr. Crisp is to be thanked for drawing our attention to an important branch of research likely to affect the public welfare.

The PRESIDENT: We have with us Mr. Hay of the Marine Division, Meteorological Office, who has been carrying out research into changes in ocean temperatures. Perhaps he will add a few words?

Mr. R. F. M. HAY: I speak with some hesitation, your president having called upon me unexpectedly. Regarding the slide Professor Manley has just shown, the thought uppermost in my mind is that such very small fluctuations are nevertheless responsible for so many changes at the Earth's surface. In fact, these slight climatic changes may represent small oscillations about a mean due to comparatively small causes. In the United States there is a school of thought which considers that volcanic dust is a possible cause of climatic fluctuations. Looking at the slide, it occurred to me that there is a very noticeable downward trend in the curve just after the eruption of Krakatoa, which becomes still more decisive after the next two big eruptions, Mont Pelée in 1902 and Katmai in 1912. So far as I know, with the exception of another small eruption in South America in 1932, there have not been many since, which implies that the atmosphere may possibly have been cleared of dust during that interval. On the other hand, some meteorologists are convinced that although a decrease of radiation is brought about by volcanic dust, on balance this makes no difference, because the energy depleted as short-wave radiation is reflected down to earth as scattered long-wave radiation.

Another way out of the difficulty is to say that the warming-up is due to some change in the earth's mean cloudiness, which is undoubtedly a factor of prime importance. Yet another way is to argue that there has been a change in the general circulation; in such a way that the interchange of air at all levels between the equatorial and the polar regions has become more marked in recent decades. A possible explanation of the rising spring and autumn decadal temperatures may be found in this increased exchange of air between the Pole and the Equator. Besides accounting for the warmer temperatures in the spring and autumn it could also explain the even greater recent seasonal rises in winter decadal temperatures in the Arctic and Spitsbergen, where the temperature rise is in part due also to the prevention of the formation of temperature inversions in winter from the same cause.

Some work on sea temperatures in the North Atlantic, in the area of the south and south-east of Iceland, has recently been carried out by Mr. Brown of the Marine Division of the Meteorological Office. In this area he found the same rises in temperature mentioned by Dr. Crisp; of the order of 2° F. in the last three or four decades. Whether that is due to one of the causes I have just mentioned, is hard to establish with certainty. There is little doubt that the day-to-day changes of the sea surface temperature are influenced by the temperature of the overlying air. However, in the case of longer periods, weeks or months, it may well be that the seasonal control between air and sea temperature is less close, or at any rate more complicated. Patches of warm water are likely to modify the pressure distribution in the same region and that, in turn, would result in a different air temperature distribution. At the present time, although it can be said that there is a fairly close relationship between changes of air and sea temperature in a particular region over periods of a few weeks or months, it is not yet possible to establish a causal relationship with any certainty.

The PRESIDENT: Perhaps Dr. Crisp may like to add a word from the biological point of view?

Dr. D. J. CRISP: I would like to deal with a few of the points made by Professor

Manley. So far as the contribution of biology is concerned, it must first be admitted that the instrumental record is far superior to any biological evidence for climatic change. Therefore, the biologist is unlikely to be able to add anything to our knowledge of the climate over the past two hundred years in Europe. If we go a little further back than the instrumental record can take us, there is only rather meagre biological evidence, for example the interpretation of tree ring widths, and this is probably insufficient of itself to form a basis from which to draw conclusions. On the other hand, if we go much further back into the geological rather than the historical time scale, the profound climatic changes are supported by ample biological evidence. This evidence rests on the assumption that existing animals and plants have not adapted themselves readily in the past to changes of climate, and their presence in deposits indicates the existence of conditions similar to those which such organisms enjoy today. Pollen analysis of terrestrial sediments, pioneered by Godwin, has been very illuminating in this context; the analysis of Foraminifera in marine deposits offers similar information regarding past conditions in the sea.

Professor Manley discussed the date when these changes can be said to have begun. It would be difficult enough from the graphs based on instrumental records to define an exact starting date (Fig. 6), but the difficulty is even greater with our very incomplete data on biological change, where the trends are masked not only by fluctuations, but also by gaps in our knowledge. Nevertheless, one can note that the period covering the twenties and thirties of this century was one in which not only the maximum rate of physical change took place, but also one which witnessed many important biological changes, for example in the bird populations of northern Europe, the changes in cod populations near Spitsbergen and Greenland, and the change in the herring and pilchard fishery in the English Channel. But it is difficult to go further and compare the extent of these changes with those of earlier periods because our information is insufficient. We can, however, see some evidence that, in conformity with the instrumental record, the biological trend favourable to southern forms may also be over; for example, the barnacles, studied regularly since 1949, have been slowly regaining their former distribution, while on the north coast of Spain a number of littoral organisms have shown a similar reversal since 1951.

In answer to the query about the effect of particularly cold winters, one must bear in mind the great store of heat in the sea, which prevents any sudden drop in the temperature of the ocean as compared with the changes in coastal water or on the land itself. Small mammals and birds suffer great mortality during severe winters, but the marine fauna is, I think, much less affected. The Baltic Sea with its low salinity and shallow water may be exceptional in witnessing dramatic losses of fish and other marine creatures in certain seasons. In British waters the changes caused by a severe spell are generally on a small scale; for example, the feather star *Antedon bifida* suddenly disappeared from the Menai Straits after the hard winter of 1940; shellfish uncovered on the shore and exposed to sharp frost are liable to be killed locally in numbers. In the main, however, major disasters to marine life are due to other causes, as for example epidemic disease such as that which destroyed much of the eel grass, *Zostera marina*, in Europe and America in the early thirties, or the phenomenon of "red tide" caused by the presence of a micro-organism in tropical water which renders it toxic to fish. Catastrophes occasioned by the intrusion of abnormally warm water are much more serious than those due to cooling; the best known example being the occasional southerly extension to the coast of Peru of El Niño, a current of warm tropical water. When this takes place enormous havoc is wrought on the fish and other organisms and on the guano birds which depend on them for food.

The PRESIDENT: I wish on your behalf to express to our lecturer and to the other distinguished scientists who have contributed to the discussion our cordial thanks.

THE SURVEY OF SOUTH GEORGIA, 1951–7

DUNCAN CARSE

"South Georgia will be remembered as journey's end for a great British polar explorer, Sir Ernest Shackleton; and that alone is enough to assure it of a place in history. His grave, marked by a rectangular headstone of rough granite, lies in the cemetery near the head of King Edward Cove on the south-west side: the Cairn and Cross, a memorial tribute set up by his former comrades, stands on the tussocky nub of Hope Point at the mouth of the Cove on the north-east side. And on a calm clear summer's day—when the water shows blue and the tussock green, when scree and crag look sandy-hot in the sun and the high tops are dazzlingly free of cloud, when perhaps the only proof of latitude and longitude is a wisp of brash ice in the bay and the 'quark' of a penguin—no environment could be more peaceful, and few more beautiful. But that is a misleading impression: the Island is in siesta."

The Times, 30 July 1954.

By the end of the Second World War, the freelance Antarctic explorer was beginning to fear for his future; by 1949, apparently moribund and plainly on the shelf, he was in atrophy. Unwilling, however, to decline so finally and so soon, and seeking re-employment, he turned for advice to the Royal Geographical Society and the Scott Polar Research Institute. Their response was encouraging, his intention approved, if only the right job could be found, something small and inexpensive and useful. Within such terms of reference, the choice was limited and easy; in fact, Dr. Brian Roberts' original suggestion—for the survey of South Georgia—was so clearly the best of the few that it never looked like being superseded. It was a "plum job," a proposal made to measure; and if the freelance Antarctic explorer were to re-establish his right of survival, he could look for no better opportunity.[1]

Historical background, and preliminaries: For practical purposes, the history of South Georgia begins on 17 January 1775, when Captain James Cook of the brig *Resolution* made a first landing—in 54° 05′ S. and 37° 18′ W. (his position)—and "took possession of the country in his Majesty's name, under a discharge of small arms": there followed 175 years of exploitation without exploration, of avid sealers and whalers, of expeditions watering and refuelling at the Island, of expeditions passing it by—though one must honourably except, especially, the German Transit of Venus Expedition (1882–3), Chaplin in 1926–30, and Kohl-Larsen in 1929–30. Nevertheless, the 1950 cartography of South Georgia was still basically Cook's running survey of 1775 tricked out with coastal detail of varying quality and form-

[1] The story of the Survey of South Georgia may be followed on the map prepared by the Directorate of Overseas Surveys in one sheet and on the scale of 1:200,000. The map (D.O.S.610) is obtainable from Edward Stanford, Ltd., 12/14, Long Acre, London, W.C.2, and costs 4s. All the place-names used in this article have been accepted by the Antarctic Place-Names Committee, and will be found, if not on D.O.S.610, on the original 3-sheet map of the Island at 1:100,000; for simplicity in identification, they have been used throughout even though chronological accuracy would have preferred "the unnamed glacier," "an unknown summit," etc. The many brief quotes in the body of the text, unacknowledged, have been lifted from *The Times*, from *Illustrated*, from the Journals of Captain James Cook, from Sir Ernest Shackleton's 'South,' and from personal diaries.

lines of sketch-map origin; orthodox triangulation did not exist, and what astrofixes there were lay far apart. The Island had become an anachronism, a paradox of the inhabited unknown; from Leith and Stromness (South Georgia Whaling Company) and Husvik (Tønsbergs Hvalfangeri) in Stromness Bay, from Grytviken (Compañia Argentina de Pesca) in Cumberland East Bay, the cosmopolitan community of seafarers frequented uncharted coasts—and were taxed for the privilege.

For the first of the South Georgia Surveys (1951–2), a simple programme of topographical survey—"What we hoped to do was to run a fairly orthodox triangulation chain along near the coast, filling in detail by photo-theodolite, and perhaps by plane-tabling and compass traverses"—and geology was proposed, and a travel technique on classical lines—"It is expected that the survey itself will be carried out mostly on ski, manhauling light sledges and/or backpacking." But an early enthusiasm to cover the whole island in a single season was gradually modified into something less optimistic and more practicable—"Our full programme was to survey the south-west coast from Cape Disappointment to King Haakon Bay, and the interior west of the Allardyce Range[1]: the geological work would be kept in step."

Organization proceeded tentatively until Salvesen's of Leith (South Georgia Whaling Company) volunteered a conditional promise of transport, then with confidence. Funds began to accumulate—from this Society, the Falkland Islands Dependencies, Odham's Press (hopeful that the mission would be Dick Barton's last), from the unexpected commercial patron—and there were offers of food and equipment—"Not only did the War Office and the Ministry of Supply between them let us have most of our clothing and much of our sledging gear on loan, but they also made us a present of 250 man-days of the Army 'Snow' Ration." And out of the somewhat erratic pool of volunteers, a 6-man party coalesced: Kevin Walton (deputy leader), Gordon Smillie and John Heaney (surveyors), Alec Trendall (geologist), Walter Roots (mountaineer), and the leader.

The 1951–2 *season:* "We arrived in South Georgia on 1 November 1951 aboard the tanker/transport *Southern Opal*, and were snugly lodged within 48 hours, and by our own request, in gaol; this official courtesy, the use of the gaol on King Edward Point as base, has been extended to all the South Georgia Surveys,[2] and is highly recommended. After setting up house, we gave priority to reconnaissance establishing, by the end of the month, that the summit ridge of the Allardyce Range and the southern approaches to Mount Paget were too Alpine for sledge travel, that the Ross Pass and the Kohl-Larsen Plateau were fact not fiction, and that there was a home stretch of good going on glacier from Royal Bay to Cumberland East Bay. This meant that we could only get at the south-west coast and hinterland by debouching westward of the Ross Pass and the Kohl-Larsen Plateau (separate journeys), and fanning out.

On December 11, we landed in Royal Bay, relayed for some days through soft snow and slush up the Ross Glacier, and pitched Camp V at the head of the Brögger Glacier on December 16; we were then virtually immobilized for eleven days by maddeningly capricious weather, always too bad for survey, occasionally good enough for travel, and we, not to outrun the growth of the map, unable to take advantage of it. But from Boxing Day onwards, conditions improved; Smillie and

[1] At this time, the Allardyce Range was considered to extend from the Drygalski Fjord area almost to Cape Nuñez.

[2] Others have since enjoyed the facility, including, so it is said, an expectant mother.

Heaney could set up their theodolites, Trendall put first foot on pillow lava, and we zigzagged southwards to pitch Camp VIII on New Year's Eve on the far side of the Spenceley Glacier.

On 1 January 1952 Trendall miskicked a step in steep crusted snow close under a small buttress, and disappeared into its attendant bergschrund; he was in easy hailing distance of our lunch halt, Walton was with him, and rescue operations were under way within minutes. By virtue of his experience,[1] Walton took charge, and insisted on being lowered into the bergschrund himself; there followed an afternoon of unskilled pully-hauly for us, of delicate crevasse-scrambling for him, until Trendall had been manœuvred up a vertical distance of 150 feet, bouncing discomfitedly on the elasticity of nylon climbing-rope and protesting that he was not "a bloody yo-yo." We camped on the spot, diagnosed Trendall as a hospital case (his left leg, though not broken, was in curious shape), lay up for a day's mild blizzard, and started back on January 3: in the neck of this unlucky col, we left a depot of one month's food and fuel for four men. After four days' hard travel, we belayed Trendall lashed flat on his "ambulance" sledge off the Nordenskjöld Glacier, and pitched Camp XIII on grass alongside the snout; in the late evening (January 7), and intending no more than a signal bonfire, we inadvertently fired the tussock, and so made contact with King Edward Point. Twenty-four hours later, Trendall was in hospital at Grytviken, we others asleep at base, and a wretched decision pending —that we should invalid him out. Trendall sailed for home in the Norwegian tanker/transport *Orwell* on January 12.

Although we were now a geologically impotent party, and further handicapped by having to repeat our first journey, there seemed no point in recasting or even postponing our second, and we landed at the head of Fortuna Bay on January 25: this time, we were on all counts more fortunate. In electing to cross the Kohl-Larsen Plateau, we were committed to an area of major undulate snowfields lying mostly between 2500 and 3000 feet: this meant lower temperatures, better surfaces, less turbulence, better visibility. By mid-February, we were across the Esmark Glacier and working close south-west of Mount Worsley; it was from here that, on February 19, we were at last able to overlook the Shackleton Gap, the low ice-sheet sprawling in a flattened irregular dome across the Island from Possession Bay to King Haakon Bay. On February 23, from Camp XI in the mouth of the north-west corrie of Smillie Peak, we discovered the Gjelstad Pass, a high narrow snow col startling the traveller with a bird's-eye panorama of Newark Bay and Jacobsen Bight; this is the only practical overland approach to the dazzling semicircle of major radical glaciers draining the mid-south-western flanks of the Allardyce Range inwards to the sea. Three days later, we pitched a last camp on the König Glacier, and returned to base via Husvik and Stromness on February 27.

In March, with the sealers once more active, it was practicable to consider a repeat first journey, possibly eked out with fortuitous landings along the south-west coast; but matters were delayed by Walton's having suddenly, and for family reasons, to return home (his place was taken by John Cheal of the Falkland Islands Dependencies Survey). On March 18, a four-man party led by Roots landed in Royal Bay with the intention of travelling light as far as the scene of Trendall's accident, picking up the depot and the threads of the survey, and breaking new

[1] In November 1946, Walton had prised John Tonkin out of a crevasse in the Wordie Ice Shelf, thereby winning the Albert Medal; for this second rescue, he was awarded the Queen's Commendation.

ground southwards; meanwhile, the leader had attached himself to the sealer *Albatros*, and was amassing rough-and-ready coastal data wherever and whenever he could.

On March 26, the *Albatros* was literally blown out of Royal Bay in a hurricane estimated at 120 knots: twenty-four hours later, Roots and Heaney were sighted crossing the lateral moraine of the Cook Glacier. Their story was perplexing. They had *not* found the depot; with snow-cover elsewhere in the Island at its yearly minimum, some local freak of precipitation had built up the trim of the col beyond recognition, and buried the depot without trace. On March 23, already short of food and fuel, they had turned back; on March 26, the same hurricane that had blasted the *Albatros* had blasted them, and with serious damage to and loss of gear; and on March 27, while Smillie and Cheal were making for Royal Bay with what was left, Roots and Heaney had set out on foot for Cumberland East Bay. There was now no time to recoup, and the last two weeks of the 1951–2 season passed in a disappointing sloth. On April 18, we embarked once again in the *Southern Opal*, and sailed for home next day.

Interim, 1952–3: No exploratory party ever achieves precisely according to plan, and we had been no exception.

"But the South Georgia Survey of 1951–2 . . . was a moderate but encouraging success; a wide arc of the interior comprising 35–40 per cent. of the whole was surveyed, and considerable stretches of the coastline redrawn. . . . It seemed a pity not to proceed, and a second season's work was undertaken on the advice of Mr. [now Sir] James Wordie, President of the Royal Geographical Society, and financed out of revenue by Sir Miles Clifford, then Governor of the Falkland Islands."

Most noticeable on our first interim sheets at 1:100,000 was the overall slimming of South Georgia (5–10 miles in an east-west line); and it was, perhaps, this shrinkage of the island that led us into the over-confidence of thinking that we could now finish the job in three journeys—north-west of the Kohl-Larsen Plateau, south-east of the Spenceley Glacier, and south-west of the Allardyce Range—and with a smaller party. With three of us from the 1951–2 season still available, the choice of personnel came easy: Smillie (deputy leader and surveyor), Trendall (geologist, limping but enthusiastic), Keith Warburton (doctor), and the leader. Salvesen's of Leith again provided transport, this time aboard the tanker *Polar Maid*, and we re-occupied our penal base on 10 October 1953.

The 1953–4 season: We were not a happy party: Warburton was suffering from a suspected duodenal ulcer, on diet, and temporarily a passenger; and there was already a psychological unease that the leader should have rationalized, but did not. A single brief reconnaissance to the north-west sufficed to confirm "that this comparatively busy stretch of coastline was one of the worst charted in South Georgia," and to serve notice "that the snow-cover over most of the area, after an exceptionally warm winter, was already in seasonal retreat." These two circumstances spelt priority; so we landed—but not Warburton, who was remaining at base to convalesce—in the Bay of Isles on October 29 intending, with this north-western area mapped, to return overland to Husvik.

Delayed by typically unprofitable weather and our own depleted manpower, we made slow progress westwards up the Brunonia Glacier and down the Ryan Glacier to Tawny Gap, where the continuity of snow- and ice-cover abruptly ended: after only 6 miles, sledging was suddenly impracticable.[1] Between November 10 and

[1] This unexpected halving of the presumed distance between the Bay of Isles and Ice Fjord made nonsense, not only of all existing maps, but also of our proposed time-table.

November 29, we backpacked along the north coast to Binder Beach, a broad blunt half-crescent of morainic rubble, established Camp XII on the far side as a temporary base, and worked southwards across the Island by way of the vestigial ice sheet of the Ernesto Pass. Returning eastwards, we pitched Camp XVIII on the Brunonia Glacier on December 3, and Smillie summed up results to date as a "nice new piece of map, but we don't know where to put it"; with only one indifferent astrofix to position us, so far, a linking triangulation with the 1951–2 season's work was vital. On December 16, after thirteen days of overcast that had never once broken long enough for survey, we conceded failure: with less than two weeks to go, if we were not to become overdue, we were now so pressed for time that work must yield to travel. On December 18, after spending two nights with Bernard Stonehouse and Nigel Bonner of the Falkland Islands Dependencies Survey in their biologists' hut beside the Grace Glacier, we were preparing to move on when the ex-MMS *Southern Paul* arrived, unheralded, bringing stores and mail. With little to show beyond the necessity for a repeat first journey (ridiculously as in 1951–2), we embarked, cutting our losses, and were back at base on the evening of December 19. We had been out just fifty days.

This parallel in misfortune with our earlier season was taken a step further by Warburton's ineffective convalescence, which now led to his being invalided home aboard the *Orwell* early in the New Year (1954). With our smaller party, this was a loss far more crippling than Trendall's had been in 1952, and we began reluctantly to face the fact that our second journey (south-east of the Spenceley Glacier) might be partly beyond our scope, and our third (south-west of the Allardyce Range) altogether.

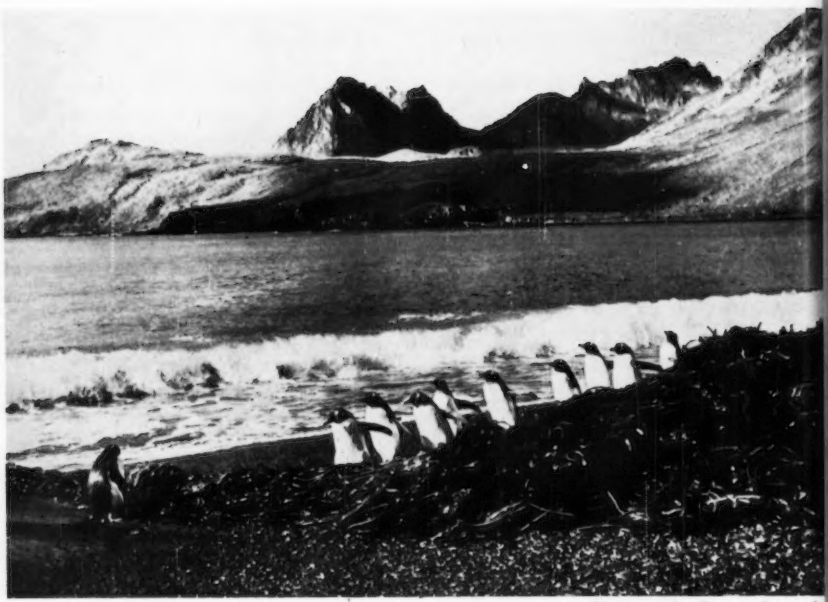
On January 11, we three left-behinds landed in Wirik Bay; it was our intention, having rounded the head of Drygalski Fjord and reached the south-west coast, to return to the Cooper Bay area for pick-up on February 25. Delayed at first by soft deep snow-cover on the Lewald Glacier, it was not until January 25 that we pitched Camp V in the confluent depression of the Salomon and Dead End Glaciers. We were now well into the igneous complex, and we did not shift camp again until Trendall, after ten days, pronounced himself rock-happy. On February 6, we reached the head of the Dead End Glacier, and found ourselves overlooking a rough-hewn, enclosed dry valley that funnelled with unquestionable finality into Drygalski Fjord. Unable to sledge further, we again cut our losses. On February 17, having done what local work we could on the retreat, we camped on the Cooper Bay grasslands, and signalled a passing catcher that same afternoon. We were picked up and returned to base next day.

At this difficult moment of deciding how to make the best of a bad job, the pattern of the earlier season was further repeated when Smillie, now beset by personal problems, returned home by mutual agreement.[1] And yet, despite reduced circumstances, things turned out none too badly. Having attached ourselves to the *Albatros*, we spent the first half of March coasting most usefully with the sealers (three landings on Annenkov Island included); and between March 23 and April 4, we footslogged in consistently outrageous weather all over the Cape Charlotte peninsula. On April 17, we again sailed for home in the *Southern Opal*.

Interim, 1954–5: If the South Georgia Survey of 1953–4 was not a failure, it was equally not a success. Our survey results, plotted on our second interim sheets at

[1] Fortunately Smillie was later able to work up his results in full.

SOUTH GEORGIA
Miles
5 0 5 10 15 20
Bird I.
Bird Sound
Elsehul
Cape North
Cape Buller
Jordan L.
Schlieper B.
Weddell Pt.
Ice Fjord
Bay of Isles
Kade Pt.
Wilson Hb.
Cheapman Bay
King Haakon Bay
Mt. Worsley 3623
Possession Bay
Antarctic Bay
Fortuna Bay
Leith
Stromness
Stromness Bay
Husvik
Shackleton Gap
Esmark Glacier
C. Nuñez
Jossac Bight
Newark Bay
Cumberland Bay
W. Bay
Grytviken
E. Bay
Hound Bay
Mt. Sugartop 3623
Nordenskjöld Glacier
Christophersen Gl.
Jacobsen Bight
Mt. Paget 9625
Annenkov I.
Ducloz Hd.
Rocky B.
Brögger Gl.
Ross Gl.
Royal Bay
C. Charlotte
Spencelay Gl.
Mt. Peterson
Novosilski Gl.
Diaz C.
Wirik Bay
Cooper Bay
Cooper I.
Drygalski Fjord
C. Disappointment
38°
37°30'
37°
36°30'
36°
54°
54°30'



Photograph: George Spencely

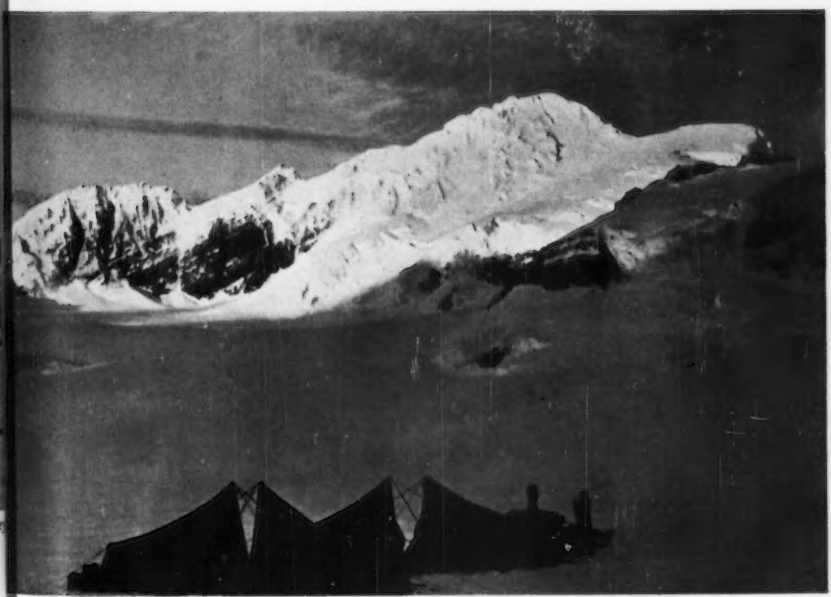
Gentoo penguins surmounting stranded kelp, Undine harbour

Photograph: George Spencely

Breaking camp on the Neumayer Glacier: Mount Spaaman behind (6367 feet)

Photograph: Tom Price

Looking north-west from summit of Mount Paterson (7205 feet); Ross Pass under cloud at extreme right between nearer, isolated summits of Salvesen Range and unbroken summit ridge of Allardyce Range, culminating at extreme left in Mount Paget (9625 feet)



Photograph: George Spenceley

In camp near head of Spenceley Glacier, Smoky Wall behind

Natural arch at about 3000 feet on the west ridge of Mount Sabatier

1:100,000, were additional evidence of the overall slimming of the Island, of a suspected reversal in the balance of heel and toe flanking Drygalski Fjord, and of the complexity and physical stature of the Salvesen Range; they were also piecemeal and a long way apart, isolated in the north-west, a tenuous extension of the 1951–2 triangulation in the south-east. Our geological results, however, were unexpectedly comprehensive, and Trendall was well pleased.

"This very brief summary will indicate that the past history and present structure of the Island are known in fair detail; and it may be worth-while to state specifically that, in my opinion, no further geological work on the Island (apart from the routine collection of specimens by surveyors, etc.) can be usefully carried out by a geologist whose movements are controlled mainly by the demands of topographical survey."

Nevertheless, had it not been for the friendly persistence in support from the then Directorate of Colonial Surveys, the leader would not have tried again.

The third of the South Georgia Surveys (1955–6), though still a very restricted enterprise, was the most ambitious.

"It is proposed to take a larger party . . . than in either the 1951–2 or 1953–4 seasons . . . the incapacity through sickness and accident of one man almost throughout each of the two previous expeditions . . . proved a crippling handicap that adversely affected the results."

The "larger party," numbering eight, were on average older men and better qualified: Warburton (deputy leader and doctor), Tony Bomford and Stan Paterson (surveyors), George Spenceley (photographer), Tom Price and Louis Baume and John Cunningham (mountaineers), and the leader.

But in planning for yet another season, we had this time to consider the imponderable of an expedition already in the field, the British South Georgia Expedition of 1954–5. Just how much would they do? And just how much would they leave for us to do? In the event, however, George Sutton's party preferred crampons to theodolites, and we were able to follow them up in the certainty of finding a full season's work.[1] And possibly more; our survey programme, in the light of past experience, was formidable.

"There are at the moment four major gaps in the map of the Island: from the Kohl-Larsen Plateau north and west to the line Sunset-Fjord–Wilson-Harbour, from the line Cape-North–Weddell-Point to Bird Sound, from Drygalski Fjord to the Novosilski Glacier south and west of the Salvesen Range, and from Rocky Bay to Newark Bay south and west of the Allardyce Range. It is these gaps—and in this order—that we hope to close."

We were also hoping, as a by-product of our closing of the first gap, to identify Shackleton's classic route from King Haakon Bay to Stromness (May 1916) beyond dispute.

Organization was on familiar lines, but slightly more elaborate: though quite possible, the insertion of an 8-man party into a 3/4-man gaol would not have been practical, and we decided to take a small prefabricated hut with accessories for the overflow. In these circumstances, our estimated costs were proportionately higher, and less easily met. Funds *did* accumulate—again from this Society and the Falkland Islands Dependencies, from the Mt. Everest Foundation, the Press, from the commercial and the individual patron—but too slowly; and when Salvesen's of

[1] A local trig scheme observed by this climbing party north and west of Newark Bay has since been incorporated in the overall triangulation.

feet on the west ridge of Mount Sabatier

Leith allowed us our third passage in the *Southern Opal*, the expedition was still uncomfortably insolvent.

The 1955–6 *season:* The third of the South Georgia Surveys got off to a flying start: we made the Island on 24 September 1955, and were throwing a housewarming party at base on October 2; two days later, with no need now for preliminary reconnaissance, we landed at the head of Fortuna Bay. Making as good time as porridgy surfaces and a persistent smoke of cloud would allow, we followed our 1952 route up the König and Neumayer Glaciers to pitch Camp VIII at the hub of the Kohl-Larsen Plateau on October 14. It was a brilliant spring day, the first of several that stand on record as the best spell of working weather in the history of the South Georgia Surveys. By October 18, with a check base, six trig stations, and an astrofix in the bag, we were ready to move on; but Paterson was now severely snowblind, unfit even to travel, and our only reasonable expedient was to split four and four into an active advance party and a static convalescent one. Luckily, Paterson recovered quickly, and we were reunited in Camp IX near the head of the Esmark Glacier on October 21: the previous day, Warburton, Baume, and Spenceley, taking advantage of their patient's rapid improvement to leave him resting alone in camp, had made a first ascent of Mount Spaaman (6367 feet), which remains the highest point yet reached in the Allardyce Range.

On October 27, we dipped across the Shackleton Gap and pitched Camp XI well up on the far side; but not without some bad moments. Returning to relay our third sledge westwards out of the Gap, we found only tracks showing where it had got away—our own fault for not having anchored it.

"Well, we followed those runaway sledge tracks for getting on for three miles—down the line of least resistance, turning beautifully with the slope, eventually missing the edge of the rough stuff and crevasses falling into King Haakon Bay by six feet—and we found it piled up against a ridge of scree."

No irreparable damage, nothing vital lost: we had been let off more lightly than we deserved.

It was from this vantage point that the last piece in the jigsaw identification of Shackleton's 1916 crossing fell into place. Already, from the head of the Esmark Glacier, we had overlooked his "ascending snow upland dividing the glaciers of the north coast from the outfalls of the south" (the Crean Glacier), and from the northern rim of the Kohl-Larsen Plateau his "great snowfield, pierced by isolated nunataks" (the head of the Fortuna Glacier); and there could be no more doubt as to his route from Antarctic Bay to Fortuna Bay: the finish, his approach into Stromness, has always been handily interpretable from description. Now, in panorama, Shackleton's start from the head of King Haakon Bay to his "gigantic bergschrund, a mile and a half long and 1000 ft. deep" lay clear below us to the east, and we could fairly assess the scope of his achievement,[1] which, in terms of distance and height and climber's hazard, the inanimate, misleading physical statistics, is less remarkable than his telling of it would imply. As Sir Raymond Priestley has said, "Shackleton, no mountaineer, dramatized the scramble across the South Georgia ranges overmuch." But in terms of courage and resolution and loyalty regardless, of the spirit of man in adversity, the Shackleton-Worsley-Crean first march across South Georgia from coast to coast must rank as a minor epic.

"I do not know how they did it, except that they had to, three men of the Heroic

[1] To relate Shackleton's description of his 1916 crossing to the 1958 map, to back this up with explanatory comment, is matter enough for a separate article—too much matter for inclusion here.

Age of Antarctic exploration with fifty feet of rope between them—and a carpenter's adze."

We were now entering an area of topographical and meteorological hurly-burly, of comparatively low broken country quite freakish in its localized effect on wind and cloud. We were not yet worried, though; experience had taught us patience in lying-up, a better ability to recognize and take our chances, and we were still making fair progress. On Armistice Day, travelling blind, we pitched Camp XVIII at the head of the Grace Glacier.

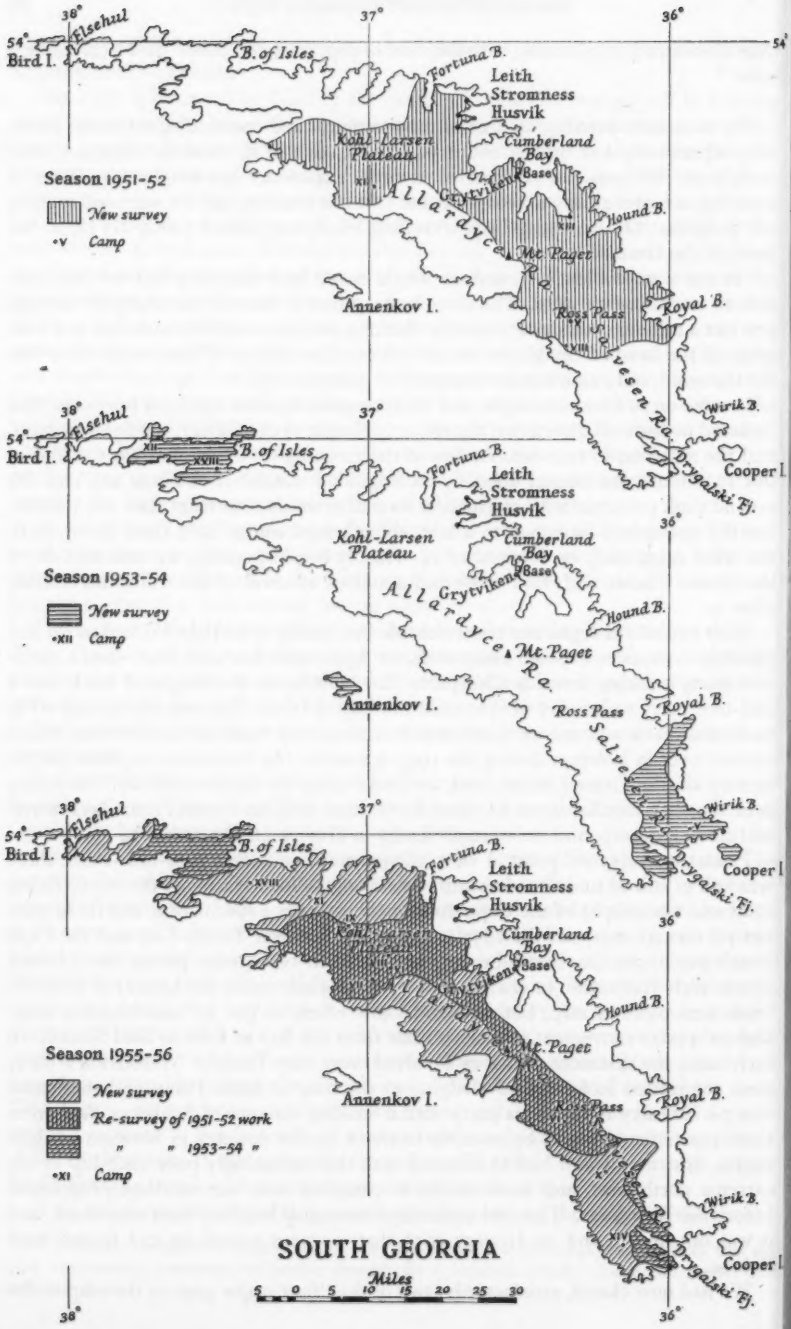
"It was a malevolent site, and we would never have chosen it had we first been able to see where we were. The smooth steep face of the col rose abruptly through 500 feet a minute's walk away, and the flanking precipices of dark rock east and west gripped the head of the glacier in two pincer-like corries. There was no free run for the wind, only an irregular serration of gashed crags."

It came on to blow overnight, and built up next day to a 100-knot hurricane that battered us from all directions: the tent guys began to carry away, the poles to bend, and the stitching to tear out. At five in the morning on November 13, the first of our four tents was ripped open by an unguided missile of airborne ice, and the second sank prostrate with exhaustion soon afterwards; but from then on, we rode out the emergency four men to a tent, though hard put to hold them down, until the wind eased early on November 14. Hastily breaking camp, we retreated down the Grace Glacier with thin snow and a vicious renewal of the williwaws chasing after us.

With two of our tents, not unserviceable but hardly to be risked in unknown and possibly even more exposed camp-sites, we again split four and four—into a good-tent party working towards Cheapman Bay upwind of the height of land, and a bad-tent party to leeward of it around the Bay of Isles. This expedient paid off in an extension of our survey westwards to connect up with the neck of the Island worked over in isolation during the 1953–4 season. On November 24, both parties met up on the Grace Glacier, and we broke camp for home next day. To return over the now familiar route of some forty miles took us a week, four days' travel and three lying-up, and we were all finally in Husvik on December 2.

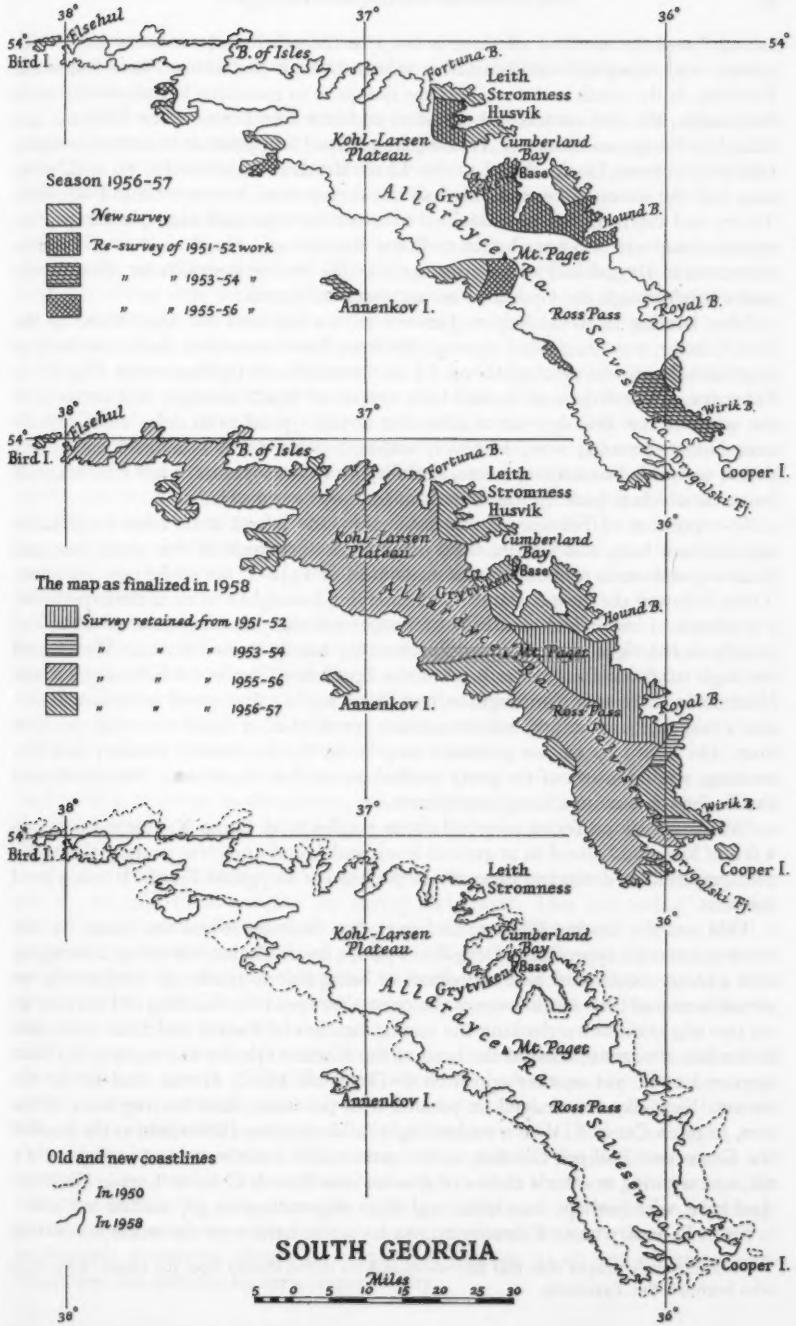
From the surveyors' point of view, the journey had been a very-near-miss: there was still a fork of unmapped country enclosing Wilson Harbour, the north-facing coast and topography of the Cape Buller peninsula were speculative, and there were not yet enough rays into the 1953–4 trig points between Tawny Gap and the Cape North peninsula. On December 13, we landed in two 4-man parties east (Sunset Fjord, with Warburton in charge) and west (Elsehul, under the leader) of Smillie's "nice new piece of map, but we don't know where to put it," and began a map-makers' pincer movement to make all fast from the Bay of Isles to Bird Sound. In each case, the distances and area involved were very limited: Warburton's party were committed to 6–7 miles' sledging to the base of Kade Point, and the leader to a 5-mile carry to bring his party within striking distance of Schlieper Bay; from these positions, it would be possible to shoot up the country in between at right angles. But we all now had to contend with the increasingly poor visibility of the extreme north-west, and were unable to complete even our minimal programme before the New Year. Then for some days our signal bonfires went unnoticed, and it was not until 9 and 10 January 1956 that we were picked up and ferried back to base.

We had now closed, satisfactorily, two of the "four major gaps in the map of the



Progress of survey, 1951–6

Note. For simplicity on so small a scale, the same coastline (as finalized in 1958) has been used in



Progress and completion of survey, 1956–8

ix sketch-maps; for the same reason, all islands have been omitted except for Bird, Annenkov, and Cooper

Island," and the work of all three seasons in the north and west was solid, with control and topographical detail of a relatively high precision. There remained, however, in the south and west, perhaps not quite so extensive but physically more formidable, the two conjectural corridors of hinterland between the Salvesen and Allardyce Ranges and the coast, running from Cape Disappointment to the Spenceley Glacier and from Ducloz Head to the Three Brothers respectively. So with more than half the season gone, and only half the survey done, we were behind schedule. To try and catch up, we now decided to telescope what had been planned as two separate journeys into one: by sea to Royal Bay, through the Ross Pass and south-eastwards to Drygalski Fjord, by sea again to the Henningsen Glacier, then north-westwards through the Gjelstad Pass and back to Husvik.

After landing in Royal Bay on January 28, we followed our 1951 route up the Ross Glacier, travelling blind through the Ross Pass into a most inclement mess of sleet and cloud, and pitched Camp VI in the middle of the Spenceley Glacier on February 5. Conditions so far had been typical of South Georgia, bad surfaces all the way and one fine day out of nine, but not so typical as to delay us effectively over known ground; now, however, within 2–3 miles of Trendall's emergency depot, we needed something better, visibility for reconnaissance, a few clear tranquil hours in which to pick up the threads of our 4-year-old survey.

The morning of February 8 was perfection, the Island at its most cooperative and brilliant best, and we practised our routine technique of the check base and local trig station to re-focus the looser control of 1951–2: we could now move on. There followed the most sustained and satisfying fortnight's work of the expedition, a synthesis of better luck and better management that kept us out of trouble, and usually in the right place at the right time: we hardly missed a trick. We crossed the high col (4000 feet) at the head of the Spenceley Glacier on February 12, and Warburton, Paterson, Cunningham, and Price, made a first ascent of Mount Paterson[1] (7205 feet, and still the loftiest summit yet climbed in South Georgia) two days later. On February 15, we pitched Camp X on the Novosilski Glacier; and that evening, while the rest of the party worked on another check base, Warburton and the leader went route-finding southwards.

"We headed for a broad snow col about 3 miles from Camp X, reached it just as a fan of low cloud oozed in at ground level, and found ourselves peering through a thin grey veil far down and distantly to the head of Drygalski Fjord. It was a good moment."

This was the Risting Glacier; and next day, between it and the coast, we discovered a second approach to Drygalski Fjord, a lower glacier, less steep, converging into a snout common to both: sure now of being able to reach our rendezvous, we struck west and then south towards the coast. We spent the morning of February 20 on two trig stations overlooking the sealing beaches of Ranvik and Diaz Cove, and in the late afternoon, crossed the head of the Harmer Glacier and camped on what appeared to be yet another approach to Drygalski Fjord. It was, and by far the easiest. Next day, we sledged on parallel with the coast, then bearing more to the east, to pitch Camp XIV on a misleadingly mild-mannered snowfield at the head of the Graae and Philippi Glaciers, quite uncrevassed hereabouts and with hardly a tilt, and seeming to offer a choice of descent into Brandt Cove or Larsen Harbour. And here, with perhaps four miles and three trig stations to go, we lost our luck.

From February 22 to February 29, we lay up in hard westerly weather scouring

[1] It seems only proper that this fine snow-and-ice dome should bear the name of the man who humped the Tavistock.

the col and our camp, not dangerously but abrasively, with the worst damp-cold drift of the season, until even more worrying than the loss of time was the damage to our tents.

"They have been out in all weathers now for nearly 120 days, they have been frequently soaked through and for long periods at a time, the canvas is rotting and worn thin by persistent heavy wet drift (really miniature ice-fragments), they have been subjected to several extremely hard blows, and they have over this last week taken a sustained beating-up that must have weakened them greatly."

On March 1, we spent the night aboard the sealer *Diaz* in Larsen Harbour; and on March 2 we returned to base. We did so, against our will, for two reasons: our probable sailing-date for home had been brought forward ten days to April 1, and we dared not take the field again until our tents, ribboned in one case to look like a Venetian blind, had been roundly cobbled.

Twenty days to play with, that was all we could spare for closing our last gap, and no second warranty to ask the favour of a chancy landing on the weather side of the Island. No time for it, either: we could not risk getting boxed in by unexplored terrain, and pinned down by equinoctial weather, until we literally missed the boat. In the circumstances, we must always have at our backs a known way of retreat. So we decided to approach the south-west face of the Allardyce Range via the Kohl-Larsen Plateau and the Gjelstad Pass, our old sledge route over again except that we should be going in up the full length of the Neumayer Glacier: there was still an indifferently mapped pocket of minor glaciers close north-west of Mount Sugartop.

March 6 was a quiet day greying from a sword-like incandescence at dawn to a heavy overcast in the late afternoon; but we had time, between landing and camping at the head of Cumberland West Bay, to shoot up the double basin of the Lyell and Geikie Glaciers from a check base well up the lateral moraine of the Neumayer Glacier. This vast triple rank of coarse rubble and dirt-impregnated ice, half a mile wide all the way from the sea to the Three Brothers, was bare of snow and quite impassable for sledgers; it took us two days' strenuous and sometimes acrobatic backpacking to get on to the glacier, awkwardly and heavily crevassed, and with all the holes wide open. On March 11, we pitched Camp VI on the Kohl-Larsen Plateau.

March 14 came in rather uncertainly fine; but needing both a trig station and to get on, we split three and five for survey and travel. This was taking a chance, since the surveyors—Bomford, Paterson, and Price—might have to return blind to a new camp; but in this event, we sledgers—Warburton, Baume, Spenceley, Cunningham, and the leader—undertook to backtrack and lead them in. We then agreed on the probable site for our emergency camp should the weather close in, and went about our separate business.

By the time we five sledgers had reached the shallow depression in the mouth of the north-west corries of Smillie Peak where we had camped in February 1952, conditions were worsening with low cloud and drift carpeting the Plateau from the east: it was then a little past noon. We pitched two tents, had a hot drink, convinced ourselves that it *was really* setting in foul, pitched the other two tents, and set out in line abreast on a compass bearing to lead in the three surveyors. Apart from the clothes we wore, we took nothing; no skis, no ski-sticks, no climbing-ropes, no ice-axes, no crampons, no spare clothing, no extra food: it was an astonishing communal aberration, explicable perhaps as an end-of-season slap-happiness, but still the leader's responsibility.

We must have backtracked about a mile before taking station to watch for the others in what was already a near-blizzard, five men strung out thwartships at the limits of visibility to intercept three; but they did not show up in half an hour, so we cut and ran for camp. We missed it, and began falling into crevasses; we doubled back, and missed it again: we were now effectually lost in nominal visibility and fading light, with more crevassing underfoot, and concerned for our comfort. Presently, we fell into an agreeable crevasse with grotto and room for all, and there we spent the night.

Some time during the small hours, the wind shifted between squalls from east to west; but this was no actual improvement, as daylight showed. Instead of breakfast, we talked things over. If the other three had not found camp, they would be needing help, and it would be up to us to give it; but for that we must have food and the tools of survival. From camp? We had no idea of our relative positions. From a whaling station? At least we could guess an approximate course for Stromness Bay. To wait for better weather? We were already deteriorating physically. To wait at all? Today's blizzard was potentially at our backs; yesterday's would have been against us, tomorrow's might be, and we should never be able to face it. We decided to go for Husvik at once.

In no visibility, over a surface of crusted skavler patterned with deep drifts of powder snow, the five of us set a shaky course for the head of the Neumayer Glacier. At first there was much sprawling in and out of crevasses; but this soon gave place merely to tripping or being blown over, a reassurance that we were solidly on the Kohl-Larsen Plateau. Hard put to it to stop, and quite unable to go back, we presently found ourselves on a steepening down-slope with more crevasses. This was not at all proper: the accepted descent from plateau to glacier is a gentle declivity without a hole. At this point of crisis, the practical leadership devolved on Cunningham, who "led magnificently in conditions and over ground which were both extremely dangerous." The tribute is Warburton's; but Baume's terser and more general commentary gives the better picture.

"Got hopelessly entangled in crevasses: decided to try and find small crevasse for temporary shelter. . . . Traversed, but only enormous ones. . . . Goggles, hood, and beard, one solid mass of ice—mits also full. . . . Situation pretty serious. Decided to traverse back looking for crevasse or way down. John leading brilliantly, and suddenly way became clear: steep ice-slope leading down—crawling over crevasses on bellies, sliding down on our bottoms."

And then, almost suddenly, the storm was behind us and above; there were irregular heapings of moraine on our right, a wash of blue sky and snow flurries on our left; and ahead, rolled out into the sun like a carpet for distinguished visitors, lay the immaculate spread of the Neumayer Glacier.

The rest was easy and comparatively safe, except at the junction of the König and Neumayer Glaciers where we linked arms in diagonal line to thread over the crevassing.

"There were rarely five people on the surface at any one time, and John on one occasion fell in to a depth of 30 feet—from which he immediately climbed up and emerged like a cork from a bottle."

In this Warburton does not exaggerate, and our arrival in late afternoon at Husvik, and still all in one piece, was better fortune than we deserved.

There followed a snug night that did a great deal for us but nothing at all for the weather: conditions inland were still severe with low cloud and drift driving before a westerly gale, and we could make no immediate move to look for the

others. In this emergency, we turned for help to the whaling factory *Southern Venturer*, newly up from the ice, and with her helicopter still in commission. Our request for a quick lift as soon as practicable was open-handedly allowed, and Warburton and the leader were airborne soon after lunch on March 16. With less wind, higher cloud, and better visibility, we intended to drop at Camp VII; Bomford, Paterson, and Price, might be there after all; it was certainly the first place to look. But half way up the Neumayer Glacier, we sighted three despondent sledgers labouring below Admiralty Peak. We circled and touched down on a good firm surface: Warburton got out wearing a whaler's peaked leather helmet. "What a funny hat!" said Bomford—and told us how they had found camp and ridden out the storm in all safety, but very worried about us! So once again, as in March 1952, we found ourselves after a near-disaster with no time to recoup, only to retrieve equipment abandoned in crisis on the Kohl-Larsen Plateau, to pack, and to re-embark. On April 3, we sailed for home in the tanker *Southern Garden*.

Putting the finishing touches: In their Survey Report (II) for 1955–6, Bomford and Paterson observe that "on a survey of this sort, some odd patches of ground on the offshore side of long peninsulas etc. remain obstinately hidden from the surveyors"; and they suggest that "the present imperfections could be remedied by one man in one season travelling round the Island with the sealers, with compass, camera, and maps." It was to try and make good these minor omissions that the leader returned to the Island alone for the 1956–7 season, reoccupying his cell on September 25, and taking passage with the sealers three days later; from then until mid-November, when the sealers notched up their permitted quota, he commuted between the *Albatros* and the *Diaz* to cover as many as possible of the coastal areas that were still topographically sub-standard.

In their Final Survey Report (IIA) for 1955–6, Bomford and Paterson regret in referring to the reliability diagram of the map of the Island that "the inhabited area around Cumberland Bay is only Grade B." This broad coastal belt extending from Fortuna Bay to Hound Bay was so plainly sub-standard that the leader decided to cover it on foot, a sometimes tiring but always pleasant chore that lasted him the rest of the season, and led subsequently to an extensive redrawing of local coastline, and a complete redrawing of local contours. Incidentally, an unexpectedly rewarding visit to the extreme north-west was made in December 1956 when Nigel Bonner (sealing inspector) discovered a rookery of upwards of 5000 Fur Seals in Jordan Cove on Bird Island.

Courtesies: It is usual when an expedition is at long last in the bag publicly to acknowledge those who did most to make it possible; but in the case of the South Georgia Surveys, covering from first to last eight years, this would drag out interminably. There have been so many on our side that to name all is hardly practicable, to discriminate would be unfair. We hope, therefore, that all who supported the several seasons' work in whatever manner will accept, in lieu of more particular thanks, this collective expression of our gratitude and regard. But there is one group of individuals, standing apart, who must be excepted.

Unlike the majority of high-latitude expeditions, we were not in the field fully self-supporting: we frequently needed transport, we sometimes accepted hospitality, we were always dependent on the goodwill of the community. To them, the whalers and sealers, who at that time had no real reason to welcome us, our thanks are especially due: to Manager Larsen-Bjelland and David Rarity of Leith, to Manager Gulbrandsen of Stromness, to Nils Olsen and Manager Ringdal of

Husvik, and to Manager Larssen and Secretary Fogt of Grytviken; to Hans Christopherson of the *Southern Paul*, to Gunner Simonsen of the *Busen X*, to Captain Hauge of the *Albatros*, and to Captains Hammerstad and Bogen of the *Diaz*; to Alec Baikie, Master of the *Southern Opal*, and to William Spence, Master of the *Polar Maid* (1953) and the *Southern Garden* (1956). These were some of the men who were friend enough to put themselves out on our behalf; if they had not, the survey of South Georgia would today still be incomplete.

Personally speaking: In 1950, I was very much afraid that the freelance Antarctic explorer had reached a point of no return: I like to think today that his position is less critical. Ours *was* a "plum job," a fair chance to rehabilitate—if we could do it well enough. And I believe we have. There is a map, there are the by-products, and of an acceptable standard: I hope that our success will encourage others, and younger men, to make the same grade; given professional craft and the amateur's enthusiasm, they should now find the going easier.

APPENDIX

A summary of results: With the publication in August 1958 of D.O.S.610, a 4-colour map of South Georgia at 1:200,000, the survey of the Island became an accomplished fact. There are still three glacier basins, those of the Christopherson, Hindle, and Weddell Glaciers, that remain "inadequately surveyed"; there are still the occasional spans of pecked coastline, especially on Annenkov Island and on Cooper Island; and a reconnaissance survey such as this has been is not, after all, intended to be the last word: nevertheless, such local inaccuracies as survive on D.O.S.610 are, at 1:200,000, hardly plottable. But to achieve these standards in an environment of such persistent inclemency, the surveyors were constrained to an inventiveness and flexibility of technique not always in the book; the methods they used, opportunist and sometimes original, have been described in detail by Bomford and Paterson in the *Empire Survey Review* for January and for April of 1958. Briefly, the transmission of proper scale and azimuth throughout the triangulation was assured by the taking of as many sun azimuths as possible, and by the measuring of check bases to an accuracy of 1:1000 every 10 miles or so of the way: astrofixes were obtained whenever possible, which was not often. Topography was recorded in the main by the taking of photographic panoramas, and by the drawing of compass-controlled panoramas, both covering the full horizon from all completed survey stations.

Next in importance to the survey results stand the major contributions to our geological knowledge of the Island made by Trendall during the 1951–2 and 1953–4 seasons: the first of his two papers on "The geology of South Georgia," was published in 1953 (F.I.D.S. Scientific Report No. 7), the second is now at the proof-reading stage. Then there are the practical by-products[1]: data "of potential interest to the seaman and navigator" (Sailing directions, 1957), meteorological comments, comprehensive photographic coverage, notes on the distribution of fauna, the evolution of a sledging ration appropriate to the needs of manhaulers in a damp-cold climate, the thorough testing of much equipment. There is also Warburton's research in 1955–6 into an aspect of fat metabolism "to determine whether, when consuming the relatively high fat diet of the sledging ration, Ketone bodies were excreted in the urine": this is mentioned in the hope that others, knowing the job has been done, will not forlornly torment themselves in the cause of science by bandying test-tube samples from tent to tent in a blizzard. And then, in more popular temper, there has been the colour

[1] Copies of all consequent papers have been lodged with the Scott Polar Research Institute, Cambridge: the leader also has a few spares.

film "Gateway to the Antarctic." This was a passable record of the whaling and sealing community, the wild life, and the pictorial impact of South Georgia in fair weather and foul: it was shot during the 1953–4 season, shaped in 1955, and chosen for the Cannes Film Festival in 1956. As a supporting documentary, it was well thought of—and has made not a penny for anyone.

Of rather greater comfort to the future traveller in South Georgia are the four seasons' accumulated findings on equipment, and anyone intending to work the interior of the Island could profitably browse first through the several kindred reports. At which point, it becomes apposite to consider one of the less acceptable frictions, unnecessary and incomprehensible, that sometimes plague relations between the man in the field and the supplier of his tools.

When the freelance equips himself with prototype gear on a loan basis, it is up to him, not only to give it a fair trial, but also to report back on performance; if he does not, he cannot expect similar help another time, and he queers the pitch for his fellows: it is equally discourteous of the manufacturer, having received a report, to go on turning out his original model with its original defects still unremedied. Neither contretemps, however, is uncommon: it would surely be better all round if the traveller could be relied on to write a report, and the manufacturer to read it.

To recommend a sledging ration: In view of the publication in the March 1958 issue of this *Journal* of "A modern sledging ration," an article detailing the Medical Research Council's First Prototype Ration, it is perhaps proper to deal shortly with the sledging ration evolved empirically during the first three of the South Georgia Surveys. In its final (1955–6) form, this sledging ration was "fundamentally satisfactory. In the party of eight men, no member suffered nutritional discomforts either physiological or psychological." Here are the man-day particulars.

	Ounces	*Calories*
Pemmican and/or meat bar	5·0	800
Butter	4·2	970
Sugar (cube)	2·4	290
Biscuits	4·2	570
Cocoa mix	2·4	290
Chocolate (milk)	2·0	230
Mint cake	1·2	130
Milk powder	0·8	110
Rolled oats	2·0	230
Potato flour	0·7	50
Onion flakes	0·4	3
Spreads (Marmite, liver paste, etc.)	0·4	?
Salt	0·2	?
Lemonade crystals	0·6	35
Cheese	0·3	36
Knorr soups	0·2	?
Curry powder	0·2	?
Dates	0·3	10
Seeded raisins	0·5	10
Corned beef and/or luncheon meat	0·5	32
	28·5	3796

On this, by current standards, modest diet, the demands of manual labour were met by all members of the 1955–6 Expedition without distress or apparent physical deterioration.

"After the first 60-day journey, it was found that two members had lost 6 pounds,

two members 2–3 pounds, three members experienced no change, and one member actually gained a few pounds."

There was, however, a tendency for the under-30's to feel hungry, and the over-35's overfed. By and large, though, this sledging ration (with only minor improvements in palatability and packaging) is one that can be confidently recommended to any who may be planning similar work in a similar environment.

It would be instructive to compare in detail the two sledging rations, the Medical Research Council's and our own, but over-lengthy; instead, a brief balance of statistics must suffice.

	M.R.C.		*S.G.S.*	
Ounces per man-day ..	34·06		28·5	
Calories per man-day ..	4816[1]		3796	
Pounds per unit (total) ..	57		54	
Pounds per unit (food) ..	42·6	*20* man-days	40·25	*24* man-days
Pounds per unit (packing) ..	14·4		13·75	
Food/total ratio	1:1·33		1:1·34	

It is the disparity in calories per man-day that most surprises. Granted that the M.R.C. sledging ration is intended for use in a polar climate rather than a damp-cold one, that the figure of 4800-plus calories per man-day is an agreed optimum arrived at only after controlled experiment to determine the energy-output of sledgers (with dogs?) and their *unrestricted* food consumption, this 1000-odd calories per man-day increase on the S.G.S. sledging ration as a proven necessity still takes some stomaching. It would be interesting to field a manhauling party in the sub-Antarctic on the Medical Research Council's First Prototype Ration, and see what size of surplus—if any—came to hand. After all, is there anyone who, given an unlimited diet, will not eat more than he actually needs?

Costs: To arrive at truly representative figures on this count is impossible; for that one would have to estimate the cash value of cost-price terms and discount, of loans and gifts in kind, of free facilities for the working-up of results, etc. What can be done, though, is to show season by season how much was actually spent, indicate where it came from, and add all up for the bank-account cost of the job. The individual figures are approximate to the nearest £25, and the totals are unlikely to be out by more than one per cent.

	1951–2	*1953–4*	*1955–6*	*1956–7*	*Totals*
Crown Agents	500	3350	2175	325	6350
R.G.S.	100		200		300
Everest Foundation ..			1000		1000
Industry and Commerce	250	(includes	450	(solo	700
Private Patrons	175	£1625 for	175	season)	350
The Press	1000	salaries)	600		1600
Film			375		375
Sale of effects	175		150		325
	£2200	£3350	£5125	£325	£11,000

If these figures suggest thrift, well, they are meant to: the survey of South Georgia *was* done on a shoestring, and very worrying that could be. For instance, the fourth season was undertaken on a credit basis, and long before the third had been paid for;

[1] Amended figure: see *Geogr. J.* **124**, 3 (1958) p. 421.

in fact, it was not until the autumn of 1957 that a further Grant[1] through the Crown Agents enabled us to square all up. But a hand-to-mouth financial policy, though comfortless, was still our choice: it had to be proved that we are both cheap and *willing* to be cheap. Just how cheap becomes apparent if one considers the cost per man per season—

1951–2	£367
1953–4 (disregarding £1625 for salaries)	£431
1955–6 (disregarding £800 for gratuities)	£541
1956–7	£325

—and the cost per square mile of the area surveyed. On the basis of £6350 direct from the taxpayer's pocket (Crown Agents) and £4650 from other sources, making £11,000 in all, and of an area surveyed of 1500 square miles, the approximate costs per square mile amount to—

from the taxpayer's pocket	£4 3 0
from other sources	£3 7 0
and from both together	£7 10 0

[1] Our thanks are due to the many who were active on our behalf in this matter of a further Grant, especially Mr. John Hall, O.B.E., M.P., for his advocacy and advice.

NEW ZEALAND AFTER TWENTY YEARS: A GEOGRAPHER'S VIEW[1]

KENNETH B. CUMBERLAND

THE WORLD ECONOMIC depression of the 1930's struck New Zealand towards the close of almost a century of hectic, hurried and uninterrupted development. The transformation of the previous century had been unparalleled in British colonial history in its speed, intensity and wholesale nature. No country, and few parts of any country more than 100,000 square miles in extent, had been subject to such change in so short a time at the hands of an immigrant alien culture. In 1840 *Aotearoa* was a predominantly forested land occupied sparsely—with little more than one person to each square mile—by a Polynesian people with a Stone Age culture. By 1938 the forest had been all but completely removed, the drier indigenous grassland tracts had been converted to croplands or burned and grazed beyond recognition, and the European and Maori population stood at more than a million and a half and lived overwhelmingly in hastily-built towns and cities.

It is almost twenty years to the day since I arrived in New Zealand and saw for the first time Tasman's land "uplifted high." I arrived with a background of urban living in the north of England, and with recent experience of British agriculture in its more difficult and extensive phases on the fells and in the dales of the West Riding. I arrived, too, with next to no knowledge of New Zealand. To a London-trained geographer in the 1930's the Dominion was still a mere appendage to one of the "remaining (southern) continents." To recall and record frankly one's more lasting impressions after the lapse of twenty years, I must admit that I found New Zealand a blatantly pioneer colonial land, incompletely transformed, inadequately tamed, still sparsely occupied, raw, fresh and new, but youthfully exciting and inviting. The depression had brought development temporarily to a standstill. In fact, the frontier of settlement was in the 1930's often in retreat. New Zealand was licking its wounds, counting its mistakes and assessing the cost of a century's hurried, ill-planned and boisterous development.

With only sixteen persons to every square mile, it used land extensively and wastefully. This was evident in the swelling acreage of land classed as in "fern, scrub and second growth," in the hundreds of thousands of acres littered with the gaunt grey stumps and fire-blackened logs of the former forest, and in the declining carrying capacity of the overgrazed, overburned and rabbit- and deer-infested tussock grasslands of the South Island high country and the basin plains of the Mackenzie and Central Otago. It was evident, above all, in the ravages which soil erosion was working in varied combinations of forms in different parts of the country—from the insidious and little noticed sheet and wind erosion of the cropland, and of the tussock grassland of the South Island, to the unique and spectacular assemblages of mass slumping and flowage of soil and subsoil in the heavier rainfall and earthquake-shaken districts of the North Island, where in as little as one generation cultural interference had been sufficient to induce a new cycle of erosion.[2]

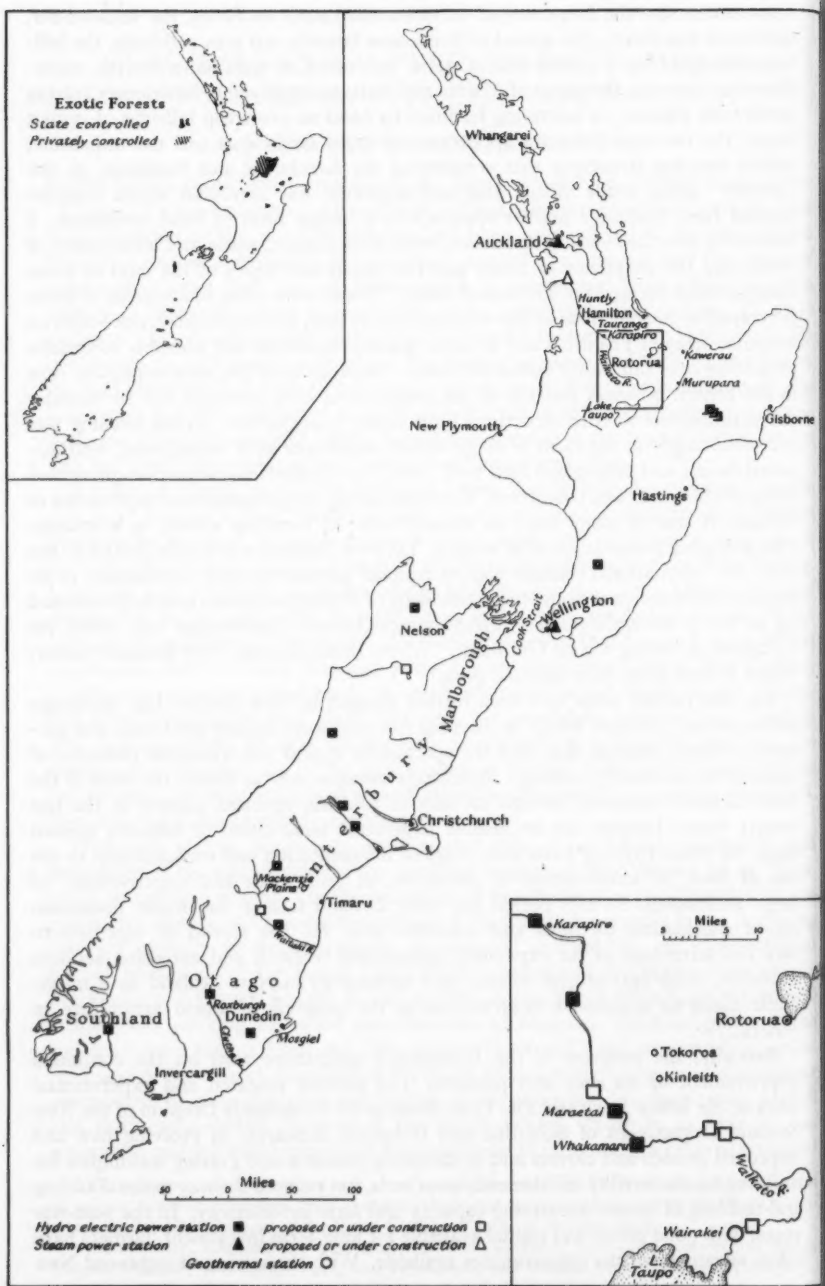
[1] This paper is an abbreviated version of an address entitled "A geographer's impression of twenty years of change in New Zealand" delivered under the auspices of the High Commissioner for New Zealand at the Royal Society of Arts on 20 May 1958.

[2] Cumberland, Kenneth B., 'Soil erosion in New Zealand,' Soil Conservation and Rivers Control Council, Wellington, 1944, and Whitcombe and Tombs Ltd., Wellington, 1947.

I remember also the frequency of unburied dead stock on farms, the uncared-for, unhoused machinery, the spread of live fences laterally out into paddocks, the hillsides occupied by a golden sea of gorse or dusted as with snow by the white-flowering manuka, the gangs of Maoris and Indians employed in laboriously cutting scrub with slashers, or scattering fertilizer by hand on oversteep hillsides. I cannot forget the raw and unkempt appearance of rural landscapes and the unpainted, untidy wooden structures that constituted the farmhouse and buildings, or the "bowser" shed, crude village hall and neglected war memorial which together formed New Zealand's nearest approach to a village form of rural settlement. I remember also the shock I experienced with New Zealand roads, the infrequency of traffic and the frequency of fords, and the extent and depth of the mud or loose shingle which formed the surfaces of roads. Towns were often reminiscent of those portrayed in cowboy films of the wild and woolly west in the pre-talkie era—with an irregular array of primitive and decrepit wooden buildings and unstable verandahs projecting over but partly paved sidewalks. Even many of the most expensive sites in the central business districts of the larger cities were occupied still by tumble-down unpainted wooden structures built eighty years before. Urban housing was overwhelmingly in the form of single-storey residences with woodframe, weather-board-facing and corrugated iron roof. And New Zealanders themselves preserved many of the forms and customs of Victorian society long rejected and superseded in Britain. It was in many ways an isolated relic of Victorian society in a strange, wild and often fantastic physical setting. Yet New Zealand was loyally British to the core. Its international outlook and its national sentiments were crystallized in its unquestioned acceptance and blind following of British policies so concisely summed up in M. J. Savage's phrase, uttered almost before Chamberlain had ended his broadcast declaring war on Germany: "Where Britain stands, New Zealand stands; where Britain goes, New Zealand goes."

The last twenty years have seen further changes in New Zealand life, landscape and economy, changes which in the long run may have equally profound and permanent effects, though they lack the spectacular appeal and wholesale character of those of the preceding century. Agriculture remains now as always the basis of the New Zealand economy, though its relative role has declined sharply in the last twenty years. Despite the impressive large-scale reclamation of hitherto unused land, the years 1938–58 have been years of intensification and consolidation in the use of land, of conservation of resources, of refinement and improvement of farm techniques. In this period the New Zealand farmer has made maximum use of mechanical methods and scientific aids. He has shown an eagerness to take full advantage of the expanding agricultural research and extension services available. And agricultural science and technology in New Zealand have meanwhile made an impressive contribution to the progress of world agriculture in general.

Basically, the progress of the Dominion's agriculture rests on the continued improvement of its soils and pastures. The pioneer research and experimental work of Sir Bruce Levy and Dr. Peter Sears at the Grasslands Division of the New Zealand Department of Scientific and Industrial Research, in evolving new and improved grasses and clovers and in designing pastures and grazing techniques for building up the fertility of inherently poor soils, has pointed the way to the doubling and trebling of livestock-carrying capacity and farm productivity. In the post-war years, with good prices and capital available for long-term investment, farmers have taken advantage of the opportunities available. With the sowing of improved New



Distribution map showing key points of New Zealand's economy

Zealand-bred grasses and clovers, increased use of artificial fertilizers, closer subdivision of farms, rotational and strip grazing, the more efficient conservation of flush spring and early summer pasture growth, the breeding of better, disease-free stock, the increasing employment of soil conservation practices, tree planting and flood prevention measures, the annual butterfat production per cow has been raised in twenty years from 235 pounds to 270 pounds, and fleece weights have been pushed up by no less than 20 per cent. Perhaps the most novel and spectacular development has been the use of aircraft in agriculture, especially in "aerial top-dressing" and other branches of "aerial farmwork." In less than a decade these have grown from experimental adventures to established and almost universal practices. Today 350 aircraft make nearly 1,500,000 flights a year to spread almost 500,000 tons of fertilizers over 4,000,000 acres of pasture land.[1] In the last six or seven years 20,000,000 acres—almost one in every three acres of total area—have been top-dressed from the air. Pastures are also seeded and crops sprayed from aircraft, and aerial means are used for distributing wire posts and other fencing materials. Before World War II New Zealand agriculture was highly mechanized. In the last twenty years, despite the war, mechanization has proceeded apace. In 1957, on New Zealand's 90,000 farms—sheep farms, dairy farms, crop farms—there were 39,000 milking-machine plants (up 66 per cent. on 1938), 22,000 shearing plants (up 220 per cent.), 85,000 tractors (up 800 per cent.) as well as more than 7000 rotary hoes and garden tractors, and 156,000 electric motors.

With increasing costs, labour shortages and the inaccessibility of the remaining idle lands, land development has become a government responsibility. Since the war, large-scale national investment in land development has enabled the Crown Lands Department and the Department of Maori Affairs, employing heavy machinery and aerial sowing and top-dressing of pastures, to make a formidable contribution to the settlement on farms of returned servicemen and of young Maori farmers. Since the war the Land Settlement Board and the Board of Maori Affairs have together made available for settlement (after clearing, reclamation, grassing, fencing and the building of modern bungalow homesteads and necessary farm buildings) more than a million acres of farmland in almost 3500 units. Another spectacular but little-publicized factor in the increased productivity of the Dominion's agriculture is the successful war waged since 1947 on the rabbit pest. The establishment of Rabbit Boards, covering in all 30,000,000 acres, and the prosecution of an all-year-round "killerpolicy" has, by the emplo yment of conventional methods[2] (plus the aerial distribution of poison baits), resulted in an impressive diminution of rabbit numbers. Exports of skins have fallen from 20,000,000 a year (1941–50 average, 13,500,000) to no more than 400,000. It is safe to say that the grazing capacity of New Zealand pastures—and especially of the tussock grasslands of Marlborough, Canterbury, Otago and Southland—has as a result been increased by the equivalent of several million sheep.

Meanwhile, however, urbanization has taken considerable areas of farmland on the fringes of New Zealand towns and cities for expanding urban uses. The "cult of the quarter acre"—a peculiarly New Zealand characteristic in suburban residential

[1] It is of interest to recall that in the *fifteen-month* duration of the Berlin airlift from 26 June 1948 to 5 October 1949, giant British and American aircraft made 277,728 flights to carry 2,326,205 tons of materials and supplies into the former German capital.

[2] Carrot and arsenic baits, phosphorized pollard, cyanide fumigation, guns, traps, etc. (See J. S. Duncan, "Combating the rabbit pest in New Zealand," *Geography*, 42, 2, pp. 120–22.)

development—is particularly prodigal in its demands on what is often the best of New Zealand's limited acreage of intrinsically first-class farm land.[1] A growing population had led to the expansion of the more intensive forms of land use, and the acreage devoted to orcharding, market gardening and nurseries has shown a striking increase, especially in the last decade.

On balance, the area of land in agricultural production is no greater than before the war. Meanwhile the numbers engaged in agriculture have remained static or revealed a slight decline; and, as a proportion of total employment, employment in primary industries (agriculture, forestry, fishing and mining) has declined from 27 per cent. to 18 per cent. However, the volume of agricultural production has expanded by more than 40 per cent. in eighteen years—and largely in the last decade. The value of the products of agriculture is up from £79 millions in 1938–9 to £349 millions in 1956–7.[2] In round figures, New Zealand has 6,000,000 cattle and 42,400,000 sheep, or almost 100,000,000 livestock units (in terms of sheep) which is equivalent to 43 units *per capita*, a figure far in excess of that of any other country. The extent of the New Zealand agricultural achievement in recent years is reinforced when it is remembered that even in 1935 (as Colin Clark and Ellsworth Huntington demonstrated),[3] the volume of agricultural production *per capita* of persons employed in agriculture was far higher than anywhere else in the world. Whilst wasteful of land, New Zealand's agricultural and pastoral economy was "efficient" twenty years ago in terms of *per capita* productivity. Today it has a much enhanced respect for the land resources upon which it is based; it uses them more wisely and expertly, and has firmly in view their long term conservation. Meanwhile, New Zealand agriculture has further raised its already high *per capita* efficiency by no less than 40 per cent.

Whilst employment in primary industries has remained stationary, and agriculture has shown a modest annual expansion in output, New Zealand's secondary industries have proved the most buoyant and lustily expansive element in the Dominion's economy. Employment in manufacturing industries has grown by 80 per cent., the volume of output has expanded almost two and a half times and the value of production by 556 per cent.—in eighteen years (1938–9 to 1956–7). Traditionally, what locally are called the processing industries, in particular the freezing and preserving of meat and the manufacture of dairy products, constituted the core of manufacturing activities and the most characteristic expression of this aspect of the economy. Although their relative importance has diminished slightly, the food-processing industries still account for one-third of the value of production of all industries and one-sixth of the total employment in manufacturing. Changes in twenty years have not been revolutionary or fundamental. Activity has expanded in step with the expansion in the volume of primary production. There has been rationalization of the dairy industry and an increase in the number of large-scale modern dairy factories—amongst them the largest in the world—particularly catering for the increasing conversion of milk into dried milk and casein. With this has gone the development of twice-daily collection from the farm-gate of whole

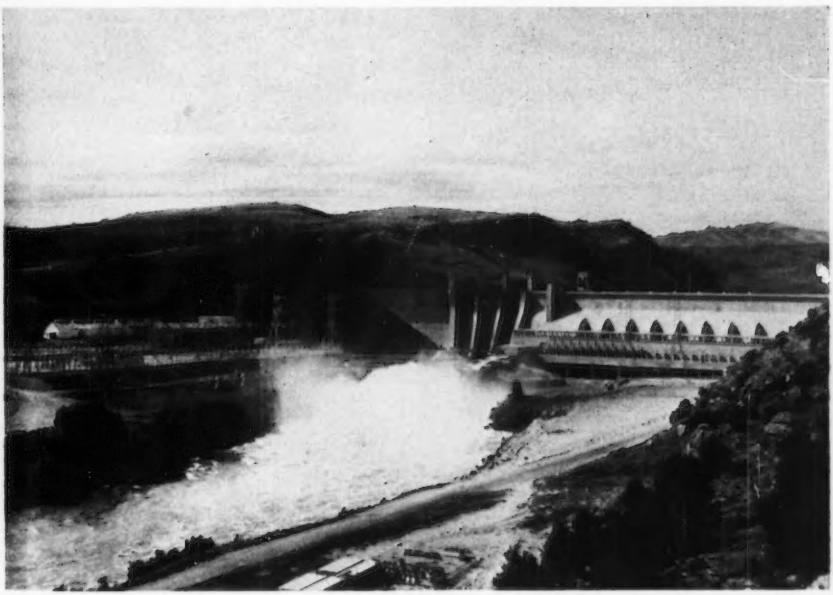
[1] Cumberland, K. B., "Planning for urban growth in Local Government," in R. J. Polaschek (edit.): *Local Government in New Zealand*, N.Z. Inst. Public Admin., Wellington, 1956.

[2] The figure for 1956–7 is "provisional."

[3] Huntington, Ellsworth, "The geography of human productivity," *Annals of the Association of American Geographers*, 33 (1943), pp. 1–31; see p. 2 for table from 'The conditions of economic progress' (1940) by Colin Clark.

By courtesy of the High Commissioner for New Zealand

Aerial top dressing, Waioru District. Mount Ruapehu in distance



By courtesy of the High Commissioner for New Zealand

Roxburgh Hydro-electric station on the Clutha river, Otago, at an advanced stage of construction; the station is now completed

By courtesy of the High Commissioner for New Zealand

Across the Tarawera river from the Tasman pulp and paper plant is the new town of Kawerau (population 3000)

By courtesy of the High Commissioner for New Zealand

Auckland from the air

milk by fleets of motor tankers. New factories have also been established to handle the increasing quantities of fresh fruit and vegetables and the home and overseas demand for processed foodstuffs. Canning and preserving factories and dehydrating and quick-freeze plants have often been established in secondary towns like Gisborne and Hastings and brought an increase there in the demand for female labour.

Textile, clothing and footwear industries are as a group the biggest employers of labour—mainly female labour—in the manufacturing field. Together with other small scale enterprises they have shown an expansion and proliferation in response to the stimulus of the wartime and post-war demand for goods formerly imported and the encouragement afforded by import licensing and currency controls. With some exceptions they are generally small factory industries, show little degree of concentration and are scattered from Whangarei to Mosgiel and Invercargill roughly in relation to population.

The third broad group in terms of employment provided are light engineering, motor-car assembly and repair, motor vehicle and aircraft body building and ship repair. Together they reflect the important role of transport—internal and external—in the Dominion's economy, and the particularly high degree of dependence of New Zealand agriculture, industry and population generally on road transport.

Fourth in terms of employment, and most rapidly expanding, are the group of industries concerned with timber resources—sawmilling, joinery, plywood and veneer manufacture and the production of pulp, paper, softboard, hardboard, boxes, cartons and bags. Their development is partly in response to the growth of population and the consequent unsatisfied demand for housing and other forms of timber construction, and partly the result of the erection recently of what are the largest industrial establishments in the country to handle a portion of the enormous annual growth and increment of exotic softwood timber. These constitute the most notable single addition to the New Zealand economy in the last twenty years and one of the most potent factors in transforming the landscape of large areas and the way of life of many thousands of New Zealanders. Twenty years ago practically the total output of sawn timber came from some hundreds of small inefficient mills each with a low cutting capacity. The industry was migratory and shifted with the receding edge of the few remaining pockets of indigenous forest. There was little incentive for large-scale capital investment. Installations were out-moded and inefficient, and housing and living conditions were primitive. But in the 1920's and early 1930's hundreds of thousands of acres of land then thought unsuitable for agriculture and situated in the main on the "bush sick" pumice soils of the Volcanic Plateau, had been planted in northern hemisphere conifers—principally *Pinus radiata* (or Monterey pine). The plantations—now totalling 900,000 acres in all—were a remarkable success and showed phenomenal rates of growth. Both the State and private companies were responsible for plantings. In 1939 the Forest Service established a sawmill of modern design at Waipa, near Rotorua, to handle timber from the earliest large plantation at Whakarewarewa, then rapidly maturing. The mill had a capacity of 20,000,000 boardfeet. This set the pattern for other mills, State and private. In 1938 the ratio of output of native to exotic timbers was 10:1. Today it is 1:1 and soon the ratio of 1938 may well be reversed. And in place of shiftless and dilapidated temporary bush encampments, the new mills give rise to permanent towns with modern amenities. There are now six plants in the spectacularly expansive pulp and paper industry, three of them integrated with sawmilling. The range of products includes mechanical and chemical pulp, newsprint,

kraft paper, tissue, paperboard, and building and insulating board. Output already has a value of more than £15,000,000 a year. With the new industries have come new towns like Tokoroa, Kinleith, Kawerau and Murupara. Improved roading, rail extensions and enlarged port facilities have all been necessary, and the large scale activities and massive capital investments of the Tasman Pulp and Paper Co. Ltd., New Zealand Forest Products Ltd., and Whakatane Paper Mills Ltd., together with the dependent development of transport and other services have worked a profound transformation of life and landscape around the northern and eastern fringes of the Volcanic Plateau. This district—and here too are concentrated not only all the North Island's new thermal, geothermal and hydro-electric projects but also the Dominion's most dynamic and richly promising pastoral frontier—has the most rapidly growing population in New Zealand, a growth which is reflected in the continued progress and prosperity also of established towns and cities like Hamilton, Rotorua, Tauranga and Auckland.[1]

So great has been the growth of manufacturing in New Zealand in the past twenty years that the Dominion's overseas financial reserves and the proceeds of the primary export industries have assumed a new significance that is not always appreciated. Whilst they were formerly used in the main to import finished manufactures and goods for direct consumption, they are now employed overwhelmingly in the purchase of capital goods (machinery and equipment) and raw materials and partly processed manufactures, in the use of which an increasing proportion of the Dominion's labour force is employed. This adds significance to the fall in the prices of primary products and the recent deterioration in the state of the Dominion's overseas funds.

Expansion in the output of primary and secondary industries and rising standards of living have been accompanied by a rapidly increasing demand for tertiary services. Employment in the service industries (including building and construction and transport) has grown absolutely and relatively even faster than in manufacturing. In 1938, 49 per cent. of the employed population found work in the tertiary group: today the figure is 55 per cent.

Amongst the service activities, the provision and distribution of electric power and the construction and operation of transport facilities have special geographic significance. Power has never been in adequate supply simultaneously in all parts of the country since the war. Domestic and industrial demand has been expanding at a rate requiring a doubling of supply every seven to ten years. Coal resources are meagre, of poor quality, "pocketed" and scattered, although output has been extended by opencast operations. Petroleum requirements are almost entirely imported. Some ninety-six per cent. of the supply of electric energy is generated by water. It is one of the Dominion's major achievements that between 1938 and 1958 the generation of electric energy has been stepped up from 1200m. kWh to over 5000m. kWh (from 750 kWh *per capita* of mean population in 1938 to 2300 in 1958). The Waikato River is the major contributor to this supply. Since the war three stations have been brought into operation on the Waikato (Karapiro, Maraetai and Whakamaru); three more are under construction, and by 1961 it is anticipated that the water of the Waikato (regulated in Lake Taupo) will have a hydro-electric generating capacity of 750,000 kW. But the bulk of New Zealand's hydro-electric power potential is in the South Island, whilst by far the larger part of the industrial expansion and of population growth is in the North Island. Recently the Roxburgh dam

[1] See also Cumberland, K. B. and J. W. Fox, 'New Zealand; a regional view,' Whitcombe and Tombs, Christchurch, 1958.

was built on the Clutha. It generates 160,000 kW and has an ultimate capacity of 320,000 kW. Preliminary work is proceeding on the Waitaki at Benmore with what will be New Zealand's largest single hydro-electric installation (capacity 480,000 kW). Meanwhile, however, local South Island demand is for the time being satisfied. Much depends on whether a submarine link is laid under Cook Strait. As the North Island approaches the stage where its economic hydro-electric potential is being rapidly used up—and until atomic sources of energy are employed—much of the future of New Zealand geography depends on the Cook Strait link. Meanwhile the North Island's embarrassment is to be staved off by the construction at Meremere near Huntly of New Zealand's only modern coal-burning station, and by the harnessing at Wairakei of geothermal steam. Using mainly open-cast coal supplies from Maramarua, Meremere will generate 180,000 kW next year and the first Wairakei station will come into operation in September 1958 and have a 68,000 kW capacity in the first instance and possibly in excess of 250,000 kW in the ultimate development. It has recently been estimated that the geothermal steam resources of the Volcanic Plateau may be of sufficient magnitude to supply in all more than a million kW of electric energy.

Economic development such as has occurred in New Zealand requires efficient transport. For the movement of livestock from farms to freezing works and ports, for the haulage of fertilizers from factories to farms, for the distribution of fuel oil and of coal, the cartage of timber, pulp and paper and of the cement and machinery used in large-scale public and private works modern transport facilities are essential. That they have been provided in New Zealand with its broken and elevated surface, its earthquakes, earth slips, landslides and its phenomenal rains and frequent flooding is a triumph of enterprise and engineering skill. Railways play a decreasing absolute and relative role. On the other hand, in the last two decades the development of roads and of motor transport—from the construction of urban and suburban motorways to the sealing of what formerly were shingle and clay tracks in the backblocks—has been quite remarkable. New Zealand has today more than 775,000 registered motor vehicles, including 465,000 private cars, against 210,000 and 155,000 respectively twenty years ago. This is one vehicle to every three persons—a ratio as high as that in the U.S.A. and Canada, and three or four times higher than in the United Kingdom. It has also been claimed that New Zealand is the world's most "air-minded"[1] country, with the sole exception of Australia, in terms of the number of passenger journeys in relation to total population. This is related in part to the high average income and living standards of New Zealand and to the physical characteristics of the country. Transport in all its forms occupies 85,000 persons—one in ten of all those in employment. This in itself is a measure of the part it plays in the economy—and geography—of the Dominion.

In twenty years New Zealand's population has grown from 1·5m. to 2·3m. mainly from natural increase, but also as the result of post-war immigration with an annual intake varying between 9000 and 29,000. A high birth rate, low death rate and a healthy level of immigration have since 1946 given New Zealand one of the highest net annual rates of population growth in the world. Meanwhile the Maori population has increased more than twice as fast as that of the *pakeha*—from 82,000 to 150,000 in twenty years. In 1938 one in every 20 New Zealanders was a Maori; twenty years later one in every 15. And for the first time in this period the Maori has revealed a shift into urban employment and residence. The urban proportion

[1] Bishop, F. H., "Air transport in New Zealand," *New Zealand Geographer*, **8**, 2 (1952), pp. 157–62.

of the Maori population has increased from 10 to 25 per cent. Some 12,000 Maoris live in Auckland alone, and, with immigrant Samoans, Tongans and Cook Islanders, give the city a significant proportion of copper-skinned Polynesian workers and residents.

The growth of population has forced up the annual construction of houses in the Dominion from 7000 to 19,000, and their cost from £10m. to £95m. An equally potent factor, however, has been the degree of post-war prosperity and the rise in incomes and living standards. The demand for houses remains unsatisfied, but New Zealand has more houses and residential units of all kinds in relation to population than ever before, and more than all but very few other countries. Population distribution reveals two marked and persistent trends: people are moving north (as they have continued to do since the 1880's, the North Island having had a majority of the population since the turn of the century) and they are moving into towns. Today the North Island has 67 or 68 per cent. of the population and more than 70 per cent. is properly termed urban. In the fifty years since New Zealand's population first reached one million, a million more people have come to live in towns. The following table illustrates both trends:

Urban area	*Population in thousands*		
	1936	*Mid*-1958 (*estimate*)	*Percentage increase*
Auckland	226	402	79
Wellington-Hutt	160	231	44
Christchurch	133	204	53
Dunedin	86	101	18
Hamilton	20	45	125
New Plymouth	19	29	53
Nelson	13	23	77
Timaru	19	25	31
Total population	1574	2280	45
Urban population	1025	1615	58

In the trail of increased urbanization (and especially with the so-called "explosive" post-war expansion of the larger urban units) have come a host of problems on a scale at which New Zealand had not had previous experience. The unprecedented demand for urban services—sewerage, airports, reconstructed city centres, administrative buildings, extensions of street systems, parks, reserves and public transport—have made enormous demands on labour, materials, rates and loan moneys. The "cult of the quarter acre"—and especially the State's adherence thereto in laying out new suburban housing estates which have been described as "expansive treeless deserts of tiles"—has sprawled urban extensions over rich countryside beyond the reach of existing services and at a hidden cost which has to be taken up by the municipalities concerned. Above all, the growth of the larger towns has revealed the inadequacy of the forms, functions, status and territorial limits of local authorities. These were created in the 1880's to meet the needs of small semi-rural communities separated from each other by farmlands. The Auckland urban area has today (to administer the local affairs of a population of 400,000)

not only a score of territorial authorities but also a superstructure of ten or more *ad hoc* bodies controlling transport, sewerage, milk distribution, fire-fighting services and so on. This is a Gilbert and Sullivan system of local government quite inadequate and quite unnecessarily cumbersome, inefficient and time-wasting to provide with speed the £8m. harbour bridge, the £17m. urban motorway system, the £12m. revolutionary sewerage disposal scheme and the £10m. international airport, all of which are so urgently required. Meanwhile, it has been estimated that the present state and degree of traffic congestion on Auckland streets costs the community from £4m. to £5m.[1] a year—without counting the costs of accident and injury and the loss of working efficiency due to worry and frayed nerves.

On the national and international scale New Zealand has matured rapidly in twenty years. With Australia, it emerged from the war with a better realization of its position in the Pacific, of its relations with the island territories on the one hand and the populous rim of Asia on the other. It also had a better appreciation of its role in the Commonwealth and of the value of its voice, its outlook and its social and economic achievements in international affairs. All this is reflected in the part it has subsequently played in United Nations, in SEATO, the South Pacific Commission and the Colombo Plan. It is revealed in its new-found concern for its own and neighbouring territories in the south-west Pacific and especially its conscientious discharge of the Trusteeship of Western Samoa and the contribution it has made in the Crown Colony of Fiji. New Zealand is a prosperous and progressive country with high material standards of life. It is paying increasing attention to non-material aspects of national life and is slowly evolving a New World, but Pacific, culture distinctly its own. Though small, not to say diminutive and remote, it has achievements to its credit out of all proportion to the size of its area and population. Its character, achievements and problems may well be worthy of a little more attention than is normally accorded to them in other parts of the world.

[1] See 'Master transport plan for metropolitan Auckland,' Vol. 1 (Survey), Regional Planning Authority, Auckland, 1955, pp. 133–6.

THE INFLUENCE OF EUROPEAN CONTACTS ON THE LANDSCAPE OF SOUTHERN NIGERIA

W. B. MORGAN

IN WEST AFRICA, as in many other parts of the world, man's activities have considerably modified the landscape. Even before the first contacts with Europe West African cultivators cut down vast areas of forest and replaced it by cropland and fallow. Pastoralists annually set fire to grassland and bush. European intervention brought economic changes which are reflected in new attitudes to land, cultivation and stock rearing, and these have produced further landscape modifications. In the French territories the settler with his plantation has introduced landscape elements which are at once obvious in their departure from West African traditions. In the British territories settlers are for the most part lacking, and yet European influences have produced marked changes through the medium of the peasant cultivator and the artisan. Southern Nigeria, with its policy of development through the African peoples themselves, affords several excellent examples.*

Southern Nigeria includes politically the Western and Eastern Regions and the Southern Cameroons; for convenience, reference will occasionally be made to neighbouring portions of Northern Nigeria with which it has or has had close economic or social contacts. Before the arrival of European traders in the fifteenth century the peoples of the territories now included in Southern Nigeria had produced a variety of social systems and agricultural practices which were, in part, responses to the different physical environments. The latter are defined broadly in terms of vegetation, soil and moisture distributions in so far as these are significant for man, *i.e.* the physical environments are "milieux" in the sense used by Richard-Molard.[1] Relief features produce only local differences except in the extreme east where the range of altitude is much greater. Since the physical factors vary in their significance for man from place to place the environmental boundaries differ in character according to local conditions. In Southern Nigeria two of these boundaries are defined mainly by vegetation distribution, and one by rainfall distribution, as will be shown below. Due to the modifications by man (with which this paper is concerned) physical environments are not static. The constant cutting and burning of trees, shrubs and grass, the modification of soils by cultivation and pastoralism, all produce changes in the appearance of the landscapes concerned—and even movement of the physical environment boundaries. Keay has pointed, for example, to the degradation of rainforest to savanna on a large scale.[2] Two of the following physical environments are based on Keay's "vegetation zones" which it is suggested may be more usefully recognized as broad physical regions of the type defined

* *Principal dates of British occupation.* 1861: British occupation of Lagos. 1885: Protectorate declared over the "Niger Districts", *i.e.*, "the territories on the line of coast between the British Protectorate of Lagos and the right or western bank of the Rio del Rey." 1886: a Royal Charter granted to the National African Co., later the Royal Niger Co. 1893: Niger Coast Protectorate declared, *i.e.* "Niger districts," together with their hinterland. 1899: Charter of the Royal Niger Co. revoked. British Government assumed direct control of the Company's territories in 1900; Company's territories south of Idah included in the Niger Coast Protectorate (renamed Southern Nigeria Protectorate). 1906: Colony of Lagos and Protectorate of Southern Nigerian amalgamated under one administration. 1914: Colony and Protectorate of Nigeria (including Northern Nigeria) inaugurated.

above. The vegetation has suffered too much modification and the terms of Keay's definition are too broad for "natural" vegetation zones to be distinguished.

(i) *Guinean* (Fig. 1).—The chief climatic characteristics are an annual rainfall in excess of fifty inches, less than three months' dry season, mean monthly humidities at dawn of ninety per cent. or more throughout the year, and normally less than two weeks of dry "harmattan" air from the north-east.[3] Soils are acid and heavily leached. They vary in consistency from the fine *ilepa* clays of the Yoruba uplands to the coarse sands of Benin and of the Awka and Awgu escarpments of Iboland. River alluvia, terrace and beach sands and gravel and estuarine muds appear in the lower reaches of the chief valleys and along the coast. Over the greater part of the area the climax vegetation is dense, lowland rainforest. On floodlands tall grasses take its place, whilst on the coastal fringe are freshwater and mangrove-swamp communities. The secondary vegetation cover consists mainly of woody plants which form a dense cover within five years of the abandonment of any clearing. The limit of this type of cover, which coincides with Keay's limit of "lowland rainforest," has been used to define the boundary of this environment. This limit is determined chiefly by length of rainy season and incidence of high humidities during the dry season. A distinction may be observed between the northern fringes of the region with a high proportion of deciduous trees in the climax forest and the more southerly portions where, with an annual rainfall of over seventy inches, evergreen species are dominant. Keay, however, claims that the vegetation differences between the northern and southern portions of his "lowland rainforest zone" are no greater than differences between other parts of the zone and he prefers to regard it as one vegetation unit.[4] The Guinean physical environment extends from sea level to an upper limit of approximately three thousand feet. It includes plateaus of crystalline materials and granites in the west and extreme east. In the Ibadan and Ilesha districts in the west, and in the outer hills of the Obudu and Oban plateaus in the east, erosion surfaces occur at approximately one thousand feet above sea level. Erosion surfaces at approximately two thousand feet occur in north-western Yorubaland, Ekiti, and the Oban Hills. These surfaces are broken by granitic *inselberge* and other residual features. They are drained southwards by streams for the most part deeply incised in valleys with convex slopes and little or no floodplain. Between the crystallines or basement complex areas there is a broad synclinal trough occupied in the west by the valley of the lower Niger, and in the east by Cretaceous and Tertiary sediments forming eastward-facing *cuestas* nowhere more than one thousand seven hundred feet above sea level. In the south the trough is occupied by the alluvia of the Niger and Cross river deltas forming a wilderness of creeks and levées fringed by sand bars and lagoons.

(ii) *Sub-Guinean.*—Like the Guinean environment the sub-Guinean has two rainfall maxima in almost every year providing annual totals of between forty and sixty inches. The term sub-Guinean is used to suggest the close climatic relationship. It follows Richard-Molard's suggestion that in West Africa areas with two rainfall maxima should be classified as "Guinean" whilst those with a single maximum should be termed "Sudanic."[5] The northern boundary has in consequence been defined by the northern limit of stations with more than 75 per cent. multi-peak years[6]—a 75 per cent. occurrence being taken as an arbitrary figure for reasonable expectation by a cultivator of the occurrence of two or more rainfall peaks. The dry season lasts between three and four months, but during that season the effect of the harmattan is more pronounced than in the Guinean environment. For two to three months in the year mean monthly relative humidities at dawn are

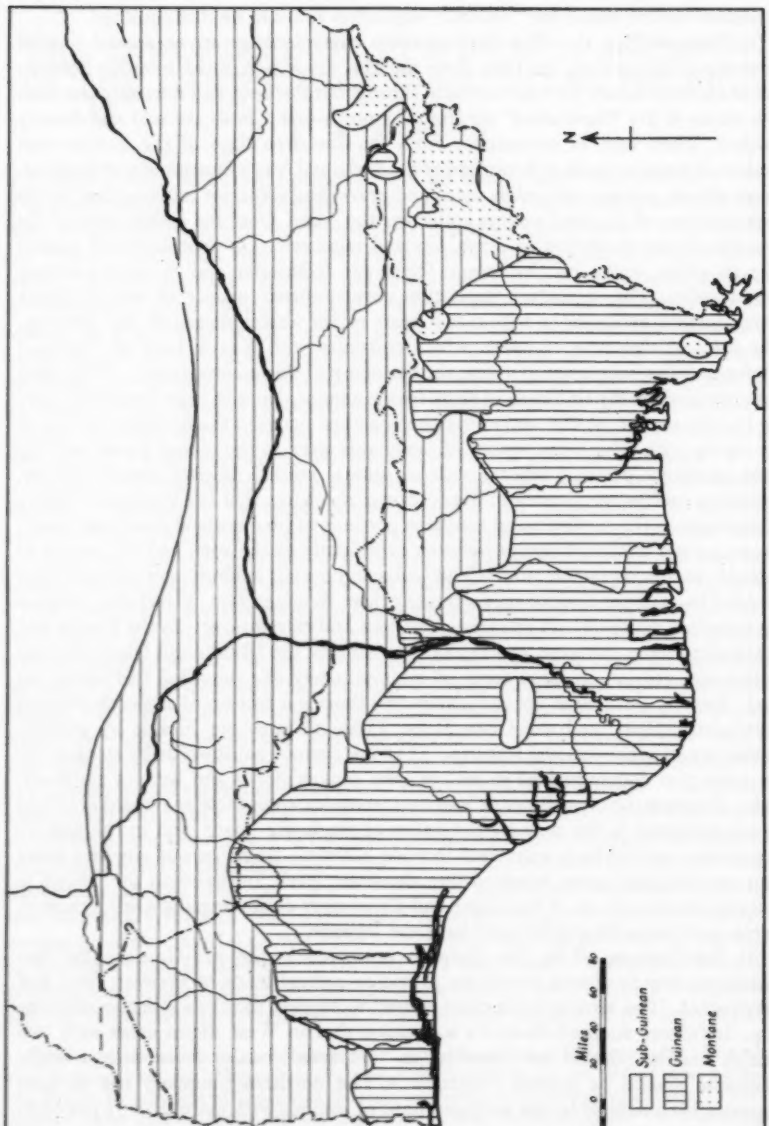


Fig. 1. Physical environments of Southern Nigeria

less than eighty per cent. Soils are acid and heavily leached. In this environment clays are mainly confined to valley-bottom lands and the greater part of the surface is occupied by sands or sandy loams. These often form only a thin mantle over concretionary ironstone, which is of common occurrence. Keay claims that the climax vegetation type is rainforest in the southern third of the area changing northwards into a transition woodland containing a mixture of fire-tolerant and fire-tender trees growing together in a closed canopy over shrubs and grasses.[7] Rainforest outliers extend far to the north, but always in exceptionally well-watered situations. Conversely the fire-tolerant species of the savanna woodlands extend to the southern limits of the environment wherever exceptionally well-drained soils occur. A notable occurrence of this type is in the isolated portion of savanna in the Sobo plains of Benin. Little can, however, be said of vegetation distributions without discussing the effects of cultivation and pastoralism, for a secondary vegetation of grasses and fire-resistant trees and shrubs is everywhere dominant. The sub-Guinean environment ranges in altitude from two hundred feet above sea level in the lowlands of the Niger valley to three thousand feet above sea level on the fringes of the Obudu plateau and the Bamenda highlands. In Southern Nigeria it consists essentially of the watersheds at between one thousand and two thousand five hundred feet above sea level between the Niger and Benue on the one hand, and the rivers flowing directly to the coast on the other. Except in northern Iboland, broad erosion surfaces with residual features are developed on the basement complex. In Iboland these are replaced by erosion surfaces developed on *cuestas* formed on sedimentary materials. With the exception of the Ogun and the headwaters of the Osse, the Anambra and the Aboine, drainage flows northwards to the Niger-Benue trough.

(iii) *Montane.*—The mountain environments, *i.e.* the environments over three thousand five hundred feet above sea level, are climatically distinct by their lower temperatures. Precipitation on the Obudu and Bamenda plateaus and on Cameroon Mountain is for the most part high, generally over one hundred inches, but there are considerable variations according to exposure. On Cameroon Mountain mist lasts for long periods at altitudes of three thousand five hundred to six thousand feet and is of common occurrence on the more northerly plateaus. On the latter, however, the dry season is more marked and the harmattan more prolonged in effect. Exposure to strong winds producing high evaporation rates is a marked feature at altitudes of over five thousand feet. Soils vary in character from the clays of the more level plateau surfaces to the coarse sands and gravels of the steeper slopes; all are highly acid. On the Bamenda plateau, at over five thousand feet, a clay topsoil with a remarkably high humus content is developed over clays derived from basalts. Forest and grassland communities containing distinct species for the most part define the Montane environment, notably Mist or Evergreen Montane Forest and Dry Montane Forest. Keay's boundaries of his Montane vegetation zone have been adopted. Some of the species are found only on one plateau, *e.g.* the mountain bamboo, *Arundinaria alpina*, and the conifer, *Podocarpus sp.*, which occur in Bamenda, but are unknown on Cameroon Mountain.[8] Woodland or scrub occurs up to approximately nine thousand five hundred feet above sea level depending on exposure, and grasslands below this height are for the most part secondary. The altitudinal range of the Montane environment extends from approximately three thousand five hundred feet above sea level to thirteen thousand three hundred and fifty feet at the summit of Cameroon Mountain. There is a prominent erosion surface at between three thousand five hundred and four thousand feet. Residuals

Fig. 1. Physical environments of Southern Nigeria

eroded in granites and lavas and the remnants of former volcanoes stand up above the general level cut for the most part in crystalline materials.

Landscape changes before the arrival of Europeans

By the sixteenth century settlement in the sub-Guinean environment and on the fringes of the Guinean appears to have produced communities of town dwellers depending on rotational bush fallow cultivation instead of on more primitive shifting methods. In the former system fallow land is constantly recleared and virgin forest is no longer sought.[9] In consequence, permanent settlement and the development of ordered government over a wide area became possible. In the west the powerful kingdom of Oyo was established on the uplands fringing the upper Ogun basin, whilst Ife and Ilesha were founded just within the rainforest environment. To the east, towns like Awka in the grasslands of northern Iboland appear to have established an early importance in trade and manufacture and probably in political influence.[10] It seems likely that the density of population in the sub-Guinean environment was greater than in the Guinean. In the former two crops a year could be produced on land easy to clear, thus reducing the area needed for cultivation. Here also could be grown the greatest variety of crops in Southern Nigeria, including all the known grains and root crops. To cultivators who were limited in their trading contacts this variety gave immense advantages in diet and in the supply of raw materials. Agriculture was developed in this environment at an early date for it seems probable that it contains the centre of origin of the West African species of yam.[11] The descriptions of Clapperton, Bowen and Burton in the nineteenth century suggest that before the advent of the cattle import from the north, amongst the Yoruba at least, cattle were formerly more common.[12] Dry season pasture on crop remains provided manure for the cultivated land and made possible a more stable agricultural system. The demand for crop land and pasture resulted in the removal of the original forests and their replacement by grasslands containing trees that were fire-resistant, or protected because of their usefulness. Grass established itself wherever dry conditions followed the main harvest so that woody plants had difficulty in taking root during the first stages of fallow. To the south the occurrence of savannas was limited by more humid or only short dry season conditions.

Before European influences were felt it seems probable that population densities in the Guinean environment were extremely low. Cultivators lived in scattered temporary clearings and depended mainly on root crops, particularly yams. Tree products, chiefly palm oil, kernels and wine, coconuts and various fruits were of great importance, so that many Guinean communities lived as much by gathering as by cultivation. With tools made of soft local iron the removal of the big trees of the rainforest was a difficult operation. The period when burning was possible was extremely limited. On the fallows woody plants quickly re-established themselves and needed considerable labour for removal. To the Yoruba the forest communities were the "epo", or "weeds" living in a remote part of the kingdom of Oyo.[13] Exceptions were the towns of Ife and Ilesha, probably seeking defensive shelter in the northern edge of the forest, and the city of Benin. The latter was established on the sandy soils of the Tertiary outcrop. These provide better drained conditions for cultivation and may have supported a less dense forest. In addition, location close to the creeks of the Niger delta gave access to easy trading routes and to abundant supplies of fish, important in a region which produced very little meat owing to the lack of pasture and to problems of disease in cattle. In the south-east, the Guinean environment of Ibo- and Ibibio-land may also have been comparatively

easy to clear since the soils consisted mainly of deep, well-drained sands. Probably dense settlement in Orlu and Owerri, Ikot Ekpene and Abak was established at an earlier date than in the heavily forested regions of the west. In the extreme east the densely forested hills of the Cross river basin still support only a few widely scattered villages where shifting agriculture is still practised. Of the early occupation of the Montane environments very little is known. In Bamenda, peoples appear to have immigrated from the Cross river valley in the late seventeenth or early eighteenth centuries and reduced most of the original forest to grassland. Later, Tikar immigrants came from the north and founded towns like Bali, Bafut and Kumbo on defensible hill tops and ridges. These were followed by Fulani pastoralists who introduced large herds of cattle on the increasing area of grassland.[14] The Obudu plateau and Cameroon Mountain are smaller in area and appear to have been avoided by the main currents of migration. The higher levels are occupied mainly by Fulani pastoralists seeking areas freer from cattle disease where pastures may easily be maintained.

European influences on the rural landscape

The first contacts with Europeans were in the Guinean environment at Benin; and later, on the beaches of the south-western lagoon coast and in the creeks of the Niger and Cross river deltas. The early Portuguese traders introduced maize, cassava, groundnuts, sweet potatoes, tobacco and various fruits including several varieties of citrus. Of these, maize and tobacco spread rapidly—particularly the former, which had become, by the seventeenth century, one of the chief crops of the sub-Guinean communities.[15] Maize became an important secondary crop in the Guinean environment, where it appears to be the only cereal which will produce abundantly under the highly humid conditions. Cassava did not spread so rapidly since yams were the preferred root crop until fallows were reduced by land shortage. None of these importations produced any great change in the Southern Nigerian landscape. However, they increased the variety of crops, made possible more widespread cultivation and improved crop rotations and combinations producing more food and supporting larger numbers of people. The trade established became mainly an export of slaves in exchange for manufactures, including iron and, at a later date, steel implements. The slave traffic resulted in concentrations of population at the coastal landing places, and clearance of the surrounding forest. Outlying villages and hamlets were raided and depopulation occurred in areas immediately inland from the slave markets, or near powerful states like Oyo in Yorubaland. The Egba of south-western Yorubaland, the Ibibio and the southern Ibo all suffered severely. The import of steel "matchets" made possible easier and more effective clearance of the forest[16] which became more attractive to settlement once it was no longer raided for slaves.

In the seventeenth and eighteenth centuries a trade in palm oil and kernels began. Eventually, after the action of the British naval squadrons and the establishment of the Protectorate of Lagos in 1861, the palm produce trade took the place of the slave trade and encouraged the occupation of the rainforest areas. From the evidence in Government intelligence and assessment reports it appears that the Ibo-speaking peoples were invading the south-eastern portions of the Guinean environment from the seventeenth century onwards.[17] They cut down the forests, replacing them by villages and hamlets surrounded by oil palm groves, farmlands and forest remnants. The oil palm forest of south-eastern Nigeria is the product of this Ibo invasion and settlement. It provides a distinctive humanized landscape

related to trading contacts with Europe.[18] Ibo immigration resulted in a contraction of the area occupied by the Ibibio-speaking peoples who were forced to retreat beyond the Aza River. There they developed an economy based, like that of the Ibo, on root crops and oil palms and able to support high densities of population.

The river valleys which had previously been avoided, partly because of the great danger of malaria, began to attract people in search of trading sites. The Etung clan of the Ekoi peoples moved down to the Cross river about 180 years ago in search of trade, building villages and establishing farms in areas formerly covered by forest. Many of them began to grow food crops, for sale to the population of the coastal ports and of the crowded areas to the south.[19] Inland, similar movements took place. In the Southern Cameroons people left the old slave-trade routes in the narrow valleys of the escarpments for the foothills zone where they planted oil palms and traded in palm produce.

Today south-eastern Nigeria is one of the most densely populated parts of West Africa with several Ibo and Ibibio districts containing over a thousand persons per square mile. Population is now concentrated along main roads, near railways and important river routes and along the coast where many small fishing villages, such as Bonny, Brass and Opobo have become ports. The extent of the modern road and railway network is illustrated in Figure 2. Remnants of the original forest survive only in a few scattered patches. The fallows of woody plants have been reduced in area and seldom does their vegetation obtain any great height before it is cut down again. In places fallow plants are now sown. For example, some Ibo plant "icheku" (*Acioa barterii*) whilst many Ibibio plant "nya" (*Macrolobium macrophyllum*).[20] In the Port Harcourt district mangrove swamps have been modified by cutting in order to supply pit props to the Enugu colleries.

In the south-west large-scale clearance of the rainforest did not begin until the nineteenth century when the Fulani armies invaded the Yoruba kingdom of Oyo, destroying a large number of settlements. Refugees fled southwards to the shelter of the Guinean environment where they made fresh clearances with imported "matchets" and defended themselves with European guns. On the northern edge of the rainforest was founded a new capital of Oyo to which the cultivators of the surrounding hamlets were forced to migrate by decree.[21] However, the capital of the Alafin of Oyo declined in importance and political power shifted to new cities founded on the sites of forest villages, such as Ibadan, established *c.* 1820. The invasion of the Guinean and southern portions of the sub-Guinean environments by refugees produced displacement of the original inhabitants, and the Egba peoples were forced southwards, founding the fortified town of Abeokuta *c.* 1830 on high rocks at the edge of the savanna. Thus warfare and the provision of new weapons and tools led to a southward shift of the Yoruba with a consequent change of landscape. Farmlands were cleared around the new towns excepting for the intervening strip of defensive home woodland or scrub, the *igbo ile*. The export of slaves in the first half of the century, of ivory, palm produce and timber in exchange for metal ware, cloth, "matchets," salt, spirits and guns led to the growth of ports like Badagry, Lagos, Ikorodu and Epe with their associated clearances. In their hinterland Ibadan, Abeokuta and Ijebu struggled to gain control of the trade routes. Between these three nuclei of settlement and cultivation lay the forest, forming a frontier or no-man's-land. It now forms a forest reserve. To the east, in Ife and Ondo Provinces, away from the main trade routes between Oyo and the coast, great areas of original forest still remained. These were to be in large part removed by the development at the turn of the century of increasing timber exports and by the production

Fig. 2. Road and railway network in Southern Nigeria

of rubber and cocoa. All suitable timber within twenty miles radius of the ports was cut down. Further inland the rivers supplied the means for wood-cutters to penetrate still deeper into the rainforest, and they were soon followed by rubber tappers.

The demand for "Lagos rubber" began with an export of 56 lbs. in 1893 which rose to over five million lbs. in 1895.[22] The chief sources were the tree *Funtumia* (*Kicksia*) *elastica* and the vines *Landolphia* and *Clitandra*. The districts around Lagos were quickly worked out and tapping advanced rapidly inland; rubber camps were formed in the forest, many of which, particularly in Benin Province, became permanent settlements with associated croplands. Many people left traditional hilltop sites and abandoned the collection of palm produce for the more lucrative rubber industry. The effect was shown in the decline of palm produce exports as rubber exports increased. Despite ordinances intended to protect rubber trees and vines there were few left by 1900, even as far from the coast as northern Ondo Province, and the rubber export had decreased to 600,000 lbs. Rubber planting was introduced, but was never very successful in Nigeria, for to compete with the Malayan product plantations were needed. Large scale development required foreign capital, but investment in land by non-Nigerians was discouraged. Village plantations of *Funtumia* were made around Benin and a few companies acquired estates in 1904, planting *Ceara* and *Hevea*, chiefly in the Sapele area.

The rapid destruction of Nigeria's rubber resources strengthened the case for forest conservancy along "somewhat similar lines to that in India".[23] The first forest reserve was constituted at Ibadan in 1899 to preserve timber and improve rubber yields and a Forestry Department with Indian-trained officials was formed in 1901. Although this department did not achieve its original aim of reserving twenty-five per cent. of the area of Nigeria for forest, it was able to acquire extensive tracts in the former inter-tribal and inter-state frontier woodlands. Thus the landscape is still dominated by dense stands of trees in areas which would otherwise have been available for agricultural expansion. To the work of this department Nigeria owes many village wood lots, urban plantations for fuel, and the planting of numerous exotics including teak, cassia and blue gum. Roadside tree plantings have greatly improved the appearance of many Nigerian highways and provide shade for pedestrians. In the Cameroons roads are often bordered by *Ficus* species introduced by the Germans. In some areas, for example in the Oban Hills of Calabar Province and in central Benin Province, the creation of forest reserves resulted in the reduction of the area available for shifting cultivation. Periodic migration into virgin bush was prevented and cultivators were forced to adopt rotational bush fallow methods in fixed locations. In effect, the landscape became almost static in appearance. Woodland and cultivated land became stable, standing out as clearly demarcated entities.

By the turn of the century numerous plants were introduced into Nigeria mainly through the agency of Government botanical stations. Seedlings were supplied to peasant farmers in the hope of developing production for export. For a short time coffee proved attractive, but prices were poor compared with cocoa, the planting of which spread rapidly in the Lagos hinterland. Areas adjacent to the railway, which was built as far north as Oshogbo by 1907, were highly valued for cocoa farms. Partly with Government encouragement kola trees were interplanted and gave a secondary resource. "Gbanja kola" (*Cola nitida*) seed was introduced from the Gold Coast, yielding larger crops of nuts which were generally preferred for flavour and storage qualities to the nuts of the indigenous variety "abata" (*C. acuminata*). Initially cocoa growing depended on the issue of seed, the provision of instruction

by the Agricultural Department and the building of fermenting and drying houses. Its distribution coincided largely with the distribution of Agricultural Department effort.[24] The first commercially productive areas were around Ilaro and Ibadan. As the road system developed planting extended eastwards as far as Owo occupying the rainforest regions of central Yorubaland. Immigrants entered in huge numbers particularly from Oyo and Ilorin Provinces. Since penetration was from the north, the savanna-ward fringe of the rainforest was cleared at an early stage although conditions here are marginal for cocoa cultivation. The forests were replaced by a landscape of fallow shrubs, small wood lots, mixed cocoa and kola plantations and farmlands divided by densely forested valleys (Fig. 3). Dense settlement concentrated on the fertile *ilepa* clays of the hill tops. As old areas declined in productivity the cocoa landscape advanced eastwards and south-eastwards.

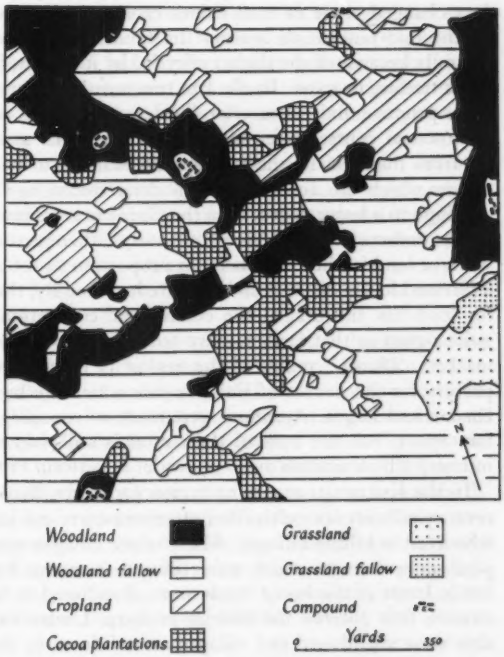


Fig. 3. Land use elements in a cocoa belt near Iwo

Outside the south-west cocoa was early introduced into Benin, Onitsha and Calabar Provinces. It did not become a popular crop, partly because oil palm production was already well established, partly because the Agricultural Department was not so concerned to develop cocoa planting there, and partly because of the lack of suitable soils. In the Southern Cameroons cocoa was grown on huge estates by the Germans, and in the same region the oil palm and above all the banana were also developed as plantation crops by European companies. The Tiko plains became in effect a forest of regularly spaced bananas, labour was imported from adjacent areas and estate villages were created. At the same time, portions of the adjacent upper Cross River basin were heavily depopulated and reverted to forest.

The sub-Guinean environment of southern Nigeria comprises the Oyo Province of Yorubaland, the Kukuruku region of northern Benin Province, northern Iboland and the north-western foothills of the Bamenda plateau. The total area is very much smaller than that of the Guinean environment and the changes which have occurred in the landscape due to European influences have been much less profound. Indeed the north-western foothills of Bamenda have neither roads nor railway and have remained almost entirely unaffected by recent economic development.

As described in an earlier paragraph, the kingdom of Oyo was invaded by Fulani armies at the beginning of the nineteenth century. Many of its towns and villages were destroyed and an area of over five hundred square miles between Shaki in the west and Ilorin in the east was severely depopulated. The capital, Old Oyo or Katunga, was abandoned and the site, together with the "finely cultivated valley" described by Clapperton in 1826, became overgrown with deciduous forest.[25] A landscape once similar in appearance, judging by Clapperton's description, to the open savanna lands in the south of the province at the present day, was thus completely changed. That change was due to internal and not European influences, but the continued existence of forest on land once highly valued for cultivation was due to a changed sense of land values caused by European commercial development. In the mid-nineteenth century the Guinean environment offered greater security not only because of the shelter afforded by its forest, but because of its proximity to ports trading in guns. In the late nineteenth century and at the present day its oil palm produce and cocoa offer greater returns per acre whilst its rapidly growing commercial centres offer more attractive social amenities. Northern Oyo is too far from main roads, the railway and markets to be resettled. Those parts of the region which are accessible to modern commerce have changed in appearance, although to a lesser degree than the Guinean areas immediately to the south. Firstly, large numbers of males have gone away either permanently or temporarily to seek work or land in the cocoa belt; in proportion to the size of the population the area cultivated has in effect been contracted. Secondly, the demand of the cocoa farmers for food has encouraged the commercial cultivation of yams, cassava, maize and guinea-corn so that farmers have tended to move towards the main routeways and markets. Thirdly, much of the region is now more important as a provider of pasture for the droves of Fulani cattle which are brought down to the markets of Ibadan and Lagos. Attempts were made to encourage increased cotton production for export, but the bulk of the cotton is still sold to the flourishing local textile industry which extends over the border into Ilorin Province in the Northern Region.

In the Kukuruku or Afema region (northern Benin Province) in the nineteenth century subsistence cultivation of guinea-corn and yams was practised by a people who lived in hilltop villages. Many of the villages were ringed with walls and occupied rocky retreats which were refuges from the Fulani armies, whilst the more fertile lands at the lower levels were abandoned to forest.[26] The British Administration first entered the district in 1904. Under its influence the old settlement sites were abandoned and villages moved down to the plains. The hills have been abandoned to forest and scrub whilst the vegetation of the plains has been in large part removed and replaced by farmlands. Oil palms flourish on the riverain lands and their growth has been encouraged. Since 1935 cocoa and kola have been introduced, but have not been very successful owing to the occurrence of a marked dry season. Generally, the region is too distant from the major markets for export produce to obtain a large share in the benefits of modern commerce. The Kukuruku region does, however, grow foodstuffs, especially yams, for sale in areas to the south and west producing cocoa and oil palm products. The difficulties in developing a cash economy on the basis of agriculture have resulted in a tendency for males to emigrate in search of work elsewhere. Barring the re-location of settlements and farmlands there have been few major changes in the landscape under British rule.

In northern Iboland landscape changes have been more profound than elsewhere in the sub-Guinean environment, partly because of the increasing population pressure on local resources and partly because of the region's greater accessibility to

main routes and markets. On the uplands between Awka, Enugu and Nsukka, Ibo farmers had early reduced the forests to open grassland with scattered low bushes. Within these grasslands they established "towns" each containing between ten thousand and sixty thousand people in dispersed compounds. Around the towns they developed a defensive screen of woodland. Modern transport conditions have encouraged a move of settlement to the roadsides whilst other new villages are being established outside former town boundaries.[27] With the increasing importance of oil palm produce in the economy the pace of planting has increased despite the fact that the region, with its marked dry season, is marginal for palm oil and kernel production. Below the easternmost escarpment at Enugu coal mining in the escarpment valleys has brought an abrupt change of landscape with its associated spoil heaps, mine buildings and miners' settlements. Close by are timber plantations, chiefly of teak, to supply pit props and fuel for the rapidly growing township of Enugu. Increasing population density in northern Iboland has created many problems. On the sandier soils the reduction of fallows and the fixing of paths and settlements due to overcrowding have led to both sheet and gully erosion. In addition great *embizes* or gullies as much as three hundred feet in depth occur at Agulu and on the eastern or Awgu escarpment. These features have been modified in part by small dams, wave-bedding and sowing with selected earth-holding plants which produce yet another landscape in Southern Nigeria.[28] In the extreme north-east in the areas occupied by the Izi Ibo, where trading contacts are poorly developed, the British occupation has resulted in the abandonment of old fortified sites, and settlement dispersal on to the farmlands.

In the Montane environment European influences on the rural landscape have been slight. The areas concerned have little original agricultural produce to offer for export, are remote from markets and poorly supplied with transport facilities. Since European settlement in Nigeria has not been encouraged there has been no development in these areas comparable to that in East Africa. Under German rule there was some reduction in the number of males in the Cameroons highlands in order to supply labour to the lowland plantations. At the same time the establishment of more peaceful conditions in south-eastern Nigeria and the Cameroons generally encouraged the immigration to these highlands of increasing numbers of Fulani pastoralists. Most of these came seasonally, but many have since become permanent settlers, and with this invasion of pastoralists the grassland area has undoubtedly increased at the expense of the remaining forests.

The changing urban landscape

With the British occupation the earth walls surrounding the Yoruba towns were allowed to crumble and decay, whilst the wooden palisades of many of the Guinean villages were removed or allowed to rot. Earthworks and ditches became overgrown or were filled for road and building extensions. As already mentioned, hilltop sites were abandoned for sites near the farmlands where more open towns were laid out with broad streets in a rectangular pattern (Fig. 4). Burton's Abeokuta with its "narrow and irregular" streets was pierced by modern thoroughfares, whilst its tamped mud and thatching was replaced by brick, mixtures of mud and cement, concrete and corrugated iron. The area of scrubland around the town equivalent to the Yoruba *igbo ile* was gradually cleared and divided into farm holdings. In Yoruba towns generally, the traditional courtyard type of house gave way to a two storey mansion in the "Brazilian" style, copied by the descendants of former

slaves from a Portuguese house-type in Brazil. In this type the courtyard is replaced by verandahs and balconies with ornamented rails. In Iboland a similar house-type has tended to replace the former compound unit. In the more important centres the offices, stores and houses of Government officials and of European and Syrian traders were established. African traders built large stores and shops. The condition of Nigerian towns, however, created problems for European settlement. Many of them were situated close to swamps or had pools of stagnant water in the numerous borrow-pits dug for the extraction of clay. The dense crowding of people within the town provided in itself a source of insect-borne disease. The chief medical officer of Lagos wrote in 1900: ". . . the sites of European towns are, for

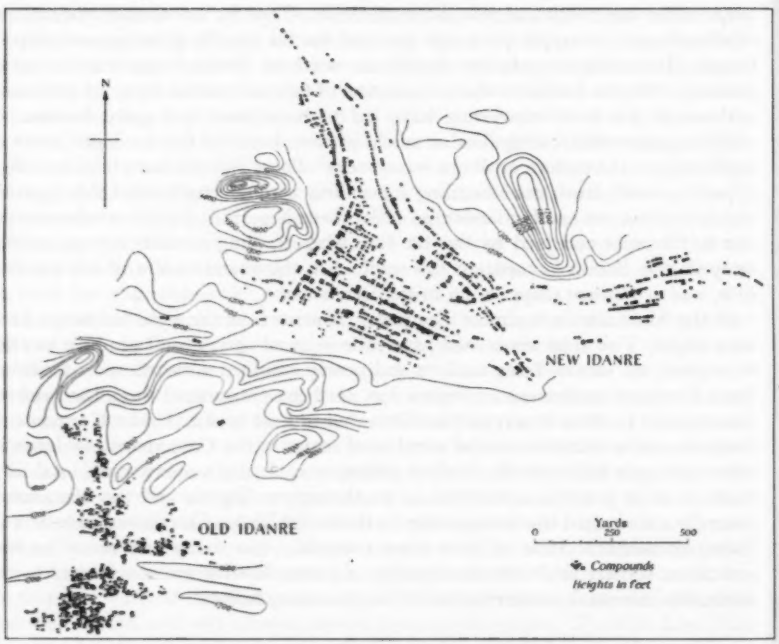


Fig. 4. Idanre villages in Ondo Province, from aerial photographs, 21.5.1951

the most part, far from being suitable for the erection of dwellings. Speaking generally, they are to be found on a low-lying sea coast, and either on or near swamps, lagoons, or river estuaries. The houses of Europeans are, as often as not, in close proximity to the native huts, or even actually amongst them. . . ."[29] Swamp drainage was begun in Lagos and Ibadan by 1900 and the reclaimed land was set aside for building purposes. In Lagos reclamation was extensive. Retaining walls were built along the foreshore, mangroves were cut and the MacGregor Canal dug to serve as a marsh drain. Beach sand and harbour dredgings, derived mainly from the extensive harbour works of 1907–17, were used to fill depressions so that the area of the island was increased and the harbour deepened.[30] Health measures became important in the planning or controlled expansion of Nigerian towns. On

the peripheries of the built-up areas farmers were ordered to plant only short crops. In many of the towns European quarters were segregated. Regulations were made to create uninhabited zones of a quarter-mile in width between the Nigerian and European areas. In the recent past European quarters were frequently built to windward and planted with shade trees. Thus Government stations are frequently located on a nearby hill or rise on one side of a town or village. In these the houses and office blocks are widely dispersed and surrounded by lawns, gardens and tree-lined avenues. In some cases landscape gardening has been attempted. The provision of piped water supplies meant the construction of reservoirs and around some of these there is a careful spacing of lawns and trees in order to improve on the previous scene. Reservoirs like that of Ibadan or Ife provide small examples, although the reservoir at Okene in Kabba Province (just outside the limits of Southern Nigeria) with its terraces, its ordered planting of exotic trees and its two artificial islands is the most outstanding. Quarters for other Europeans—traders, soldiers, engineers and those in the professions—were established on similar lines to those built for Government officers. Separation of quarters was maintained as late as 1939 when Government recommendations for town planning recognized the need for a separate European residential area surrounded by an open space, but suggested that it should not be too far from the business area since otherwise few Europeans would be able to "avail themselves of the advantages of separation."[31] Today separation is tending to disappear as more and more Nigerians enter the higher ranks of administration and take managerial positions. The garden suburbs created by the British administration are becoming a part of the Nigerian urban landscape.

Within the Southern Nigerian towns immigration led to overcrowding and the rapid growth of unplanned sprawls outside the old walls. Streets were narrowed by the extension in some cases of the frontages of private property. In Epe, for example, the realization of the value of land resulted in the reduction of some street widths from twenty to six feet.[32] In Lagos the courtyards within the compounds were occupied by shacks built of bamboo and corrugated iron, thus producing densely populated slums. Between the compounds the streets of bare earth were heavily eroded during rainstorms. In some cases building foundations were undermined; in others, gutters were left above street level. Street widths had to be regulated and minimum building standards enforced. Tarred roads with concrete gutters were made and during the first decade of this century town planning was attempted.

Planned towns with broad streets at right angles to one another and with building plots of uniform size were laid out at the New Town of Ebute Meta forming a mainland extension of Lagos, and at Port Harcourt, Aba and Enugu. Modern waterworks and power stations were constructed whilst timber plantations were established to maintain domestic and public fuel supplies. Many of the larger markets were laid out anew and improved by the building of concrete shelters. Public buildings of brick, concrete and steel were erected. Where formerly a town had consisted of a number of crowded villages focusing on a central market and the area occupied by the ruling authority, now it had in addition distinct business, shopping and government districts with planned spacious suburbs. Traders from other parts of Nigeria have come to the towns in increasing numbers and occupy separate quarters. The Yoruba towns, for example, acquired districts occupied mainly by Hausa who had come from Northern Nigeria. Some degree of segregation thus occurs between different Nigerian communities within a town, and often leads to contrasts in types of housing, market and other amenities.

New developments

Since 1945 the pace of Nigerian development has increased. Investment has been made in new industries and Government loans or gifts have financed agricultural and resettlement schemes, and public services and institutions. Locally new types of landscape have resulted.

In the new agricultural schemes the large scale organization of peasant cultivation has been attempted, frequently combining the use of mechanized equipment. The Eruwa Mechanized Farming Scheme, initiated in 1951, includes a considerable acreage of contour-ploughed land under pineapples for the local canning industry. The contrast between the huge ordered fields under a single crop and the small patches with their mixed crops on the neighbouring lands is startling. In the Eastern Region, plantation schemes for the cultivation of oil palms, cocoa, rubber, cashew and coffee, and of citrus fruits are being developed. In the Western Region a scheme of integrated rural development, including the use of hydro-electric power, is planned for the Upper Ogun River basin. The Upper Ogun Estate with its contour-ploughed strips and improved pastures has already been established. Improved pastures exist also on the Fashola Government Farm near Oyo, whilst on the Obudu plateau the Eastern Regional Production Development Board has a 20,000 acre ranch. Other schemes include swamp reclamation for rice-growing in the deltas of the Niger and Cross rivers, and market gardening at Enugu, using contour ridging and nightsoil compost.[33] Thus a variety of schemes has been initiated which, if successful, will greatly modify the Nigerian scene.

With regard to the development of industrial landscapes there are at present only a few manufacturing industries. These are concerned with canning food, bottling fruit juice, mineral waters and beer, preparing tobacco, milling flour, crushing groundnuts and oil palm fruit, and making margarine, soap and metal oil-containers. At Apapa, opposite Lagos, the Nigerian equivalent of an industrial trading estate has been laid out on reclaimed land; a broad, level area has been provided with roads and drainage ready for occupation by warehouses, factories and offices.

The examination of landscape changes in Nigeria has shown that European influences have produced the most marked effects in the towns, since these are the centres of commerce and political authority. In the rural areas the greatest changes have occurred in the Guinean environment where perennial crops, producing for external exchange, dominate the landscape. The introduction of modern methods of transport and modern trading facilities has done more to effect these changes than any other factor. In the lowlands of the Eastern Region the development of an oil-palm bush landscape began as early as the end of the eighteenth century. In the west the "cocoa belt" landscape was not developed until towards the end of the nineteenth century, but was assisted by earlier population movements due to the Fulani conquest of Oyo. In the sub-Guinean and Montane environments, generally unsuited to the cultivation of perennials like cocoa and the oil palm, landscape changes have been much less marked. In the former they are associated mainly with changes in settlement distribution and in the latter with an increase in pastoral activities. Development schemes involving resettlement of population and the introduction of modern agricultural techniques are producing, as yet on a small scale, new types of landscape. There is little industrial development at present, although the trading estate at Apapa gives some indication of a possible industrial and commercial urban landscape of the future.

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[16] See note on the effects of introducing the steel axe into the Amazon basin in: P. Gourou, 'The tropical world,' translated by E. D. Laborde, 1953, p. 26, n. 2.

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[31] Government of Nigeria, 'Selection of sites for towns and government residential areas,' Lagos, 1939.

[32] Annual Report for the Colony of Lagos, 1902, p. 43.

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THE EASTERN MARSHES OF MESOPOTAMIA

H. St.J. B. PHILBY

The following description of a journey through the marshes is extracted from a chapter on 'Amara in an unpublished work.

So I said goodbye to 'Amara, proceeding next morning (15 January 1917) by launch down the Chahala canal to Musaida. . . . I then pursued my way by launch down the winding channel of the Husaiki canal, hemmed in on either side by splendid rice-fields extending to the limits of vision, to a point within a short distance of the Dawai and Battat canals, marking the boundary of the Michariya *muqata'a* which I had inspected with Gertrude Bell. From here we retraced our course up the canal to the village of 'Araibi Pasha for a farewell visit of courtesy. The old man was well enough to walk a little, feebly, though I scarcely thought I should ever see him again on this earth as I shook his withered hand and said goodbye, before proceeding down the Zubair (or main) branch of the Chahala to the huge reed-hut village of his son and heir, Muhammad. . . .

Next morning (16th) I was up early to begin the exploration of the marshes which, so far as I know, were at that time virgin ground to the European, though the Turco-Persian Boundary Commission had skirted their eastern fringes in February 1914. Leaving the launch to return to 'Amara, we set out in three *mashhufs* provided by our host: my party including the faithful Mulla Rabat, the slave 'Abid and a lad named Minshad. . . . The Tal'a channel, which we followed, forks a little way below the village to form the A'aiwij and 'Adil canals; and it was down the latter that we now proceeded through rice lands of astonishing richness, studded at frequent intervals along the canal banks with enormous villages, teeming with humanity. . . . Here and there the canal broadened out into fair-sized lakes until we reached the great Haur, or marsh-sea, itself at the point where the two rejoined each other. At first we paddled the great canoes along the channels intersecting the reedy marsh. Then a great lake (or *barqa*) opened out before us, the crossing of which brought us to a large village of reed huts called Baidha, whose principal feature was a clay fort surmounting a slight eminence on a long thin tongue of dry land, extending, they said, to Halfaya on the Persian frontier. Our host here was the headman, Muhammad ibn Bahar, who received us with the courteous hospitality common to primitive man, and conducted me over the village. I was astonished to find here numerous traces of the brick foundations of an ancient long-forgotten civilization and broken potsherds of a coarse green hue. We had time also before sunset to visit the similar ancient ruins of Abu-Dhahab, now a marsh-girt island on the route to Huwaiza, before returning to our host's guest-house for dinner. We talked afterwards of the traditions and history of the locality, which was clearly once a village or town on the great Nahrawan canal of ancient times. Leaving the Tigris some way above Baghdad, this canal ran down parallel with the river's left bank to join the Shatt al 'Arab, or possibly even the Karun river. The destruction of the Mesopotamian canal system by the Mongols of Hulagu Khan had doubtless given birth to these marshes, and nothing remains of this ancient glory of Iraq in these parts except certain straight sections of waterway through the reeds, which undoubtedly are remnants of the Nahrawan canal itself, or a branch of it known to

local tradition as al Khait (the thread). The silence of the marsh was astonishing after nightfall, as we sat talking round a merry fire, which seemed to menace the reed huts of the settlement. Afar off we could hear quite distinctly the dull thud of the bombardment going on round Kut—a hundred miles away! And, when we had had our fill of serious conversation, the local funny man, named Habib, was introduced to divert us with his coarse miming. In due course I was conducted to another hut, tenanted by a whole family as well as its cattle and a watch-dog, to sleep: and I certainly slept well enough in spite of my strange surroundings.

The Ma'dan, or marsh folk of Mesopotamia, were at that time certainly to be reckoned among the most primitive races of mankind. Islam, it is true, had penetrated their watery stronghold, and left a thin veneer of civilization in its train to cover the essential paganism of their life. The rags they wore were rather an unconscious concession to some vague ideal of civilization than a covering for their nakedness or a protection against the weather. To some extent they were actually a nuisance in the amphibious conditions of marsh life; and neither men nor women —the children of both sexes of course went stark naked—had the slightest compunction in exposing their bodies to save their garments from a wetting. The men also had no hesitation in stripping naked to dive into the water or to manipulate their canoes; and it was not an uncommon thing to see a man making water in public—and often with broad jesting—from the prow of his boat. The women, so far as I could see, were quiet and modest in their deportment, though they seemed to mix freely enough with the men and, in fact, had a reputation for easy complaisance, especially on the borders of the marshland, where their charm and beauty have always been a temptation to their neighbours on the river and at the markets which they frequent to dispose of their produce. At this time the marshes did a roaring trade in eggs and chickens with the troops and other passengers travelling on the river-craft. Their staple product was, however, the reeds of their marshes, always

in great demand among the tribes themselves and for the hutments of our labour gangs—an easy crop requiring no more than the cutting and bundling, and renewing itself each year without human attention. A secondary, but very important, industry was dairy-farming for milk and its by-products—butter, cheese, etc. The marshes formed an ideal grazing ground for large herds of buffaloes, which flourished particularly on the young shoots of the reeds in spring-time. To increase and maintain the supply of such succulent pasture, the marshes are periodically set on fire to burn out the old dry reeds and make room for the new crop which, with plentiful water and an unfailing sun, comes to maturity with astonishing rapidity. So the marshman scarce needs to labour for the fruits of the earth. Many of them of course work on the rice-fields for a share of the harvested crop, and the reeds for hutting have to be cut; but for the rest nature provides for all man's requirements without exertion on his part, and in many respects these marsh-folk seem to lead an idyllic existence, and reflect the fact in their beautiful bodies.

Our flotilla was now increased to nine *mashhufs* for the journey across the heart of the marshes, the people of Baidha and its neighbourhood having decided to celebrate my visit as a public holiday to show off their skill as oarsmen, fishermen, hunters and swimmers. They were certainly very proficient in all these matters, though we drew blank for the wild pig, which are said to be very plentiful in the drier parts of the marsh. Their fishing is done entirely by tridents, consisting of a three-pronged bit of metal fixed to the end of a long reed, with which the fisher, standing at the prow of his canoe and intently watching the depths below him as it floats slowly by, stabs the water with a sharp, straight, downward stroke, which sometimes, though not often, results in his following it unintentionally into the water to the intense amusement of his companions. The number of fish successfully speared in this manner was, however, surprising, the result of generations of practice; and the marsh population evidently relies on fish as an important part of its diet although, at this period at any rate, they had no sufficiently rapid means of transport to put their catch on the neighbouring markets in competition with the riverain netting (or trapping) industry.

Our first stop was at a group of ruins on a low hillock called al Sauda, southward of Baidha, where I again made a collection of potsherds. Incidentally, having no compass with me, I was constrained to use the sun as a substitute to give me my bearings which, with an assumed speed for the canoe and my watch, ultimately enabled me to work out quite a satisfactory traverse of the journey through hitherto uncharted territory. Beyond al Sauda, we passed by the villages of Diban and Abu-Khasaf, situated on similar bits of solid ground in the reedy wilderness, before striking out on to an immense *barqa*, a veritable inland sea with water of considerable depth and by no means calm, owing to a fresh breeze which was blowing at the time and, to my untutored mind, seemed to menace our frail craft with imminent danger. On the further side of this great lake we entered a very well-defined, broad channel between reeds, which is still known locally by the name of Nahrawan and thus preserves an ancient tradition. Later in the day we came upon a second long section of the same canal, but for most of the time our course meandered through a forest of reeds, often necessitating laborious poling, and even pushing the canoes over practically dry ground. Every now and then the scene was varied with a wide deep lake studded with islands of tall reeds. Thus eventually we came to a largish island of more or less dry land with a series of reed hut villages, belonging to the Nawafil (Shudda) group of the Ma'dan. Our track lay through one of these, al 'Aqab, with another (al Sakhra) away to our right, while our actual goal

was a yet larger settlement called Baidha Nawafil, dominating quite a prominent whale-back ridge.

It was now about sunset and, as we approached the place, we heard the noise of a great tumult accompanied by much rifle-firing. Not knowing what this might portend, we called a halt, while Muhammad ibn Bahar, our host of the previous night, went forward to investigate. Minshad remained with me, and eventually, at a signal from ahead, we crept unobtrusively into the village, to be received into his hut by a man named Zughaiyir of the Nawafil. The uproar, he explained to us, had arisen out of a petty local dispute, based on an old blood-feud between two sections of the tribe. The firing of shots went on sporadically for some time after our arrival but, so far as I could gather, no great harm was done to anybody. In Zughaiyir's hut it was all very snug and comfortable, as we sat round a roaring fire awaiting dinner, in the preparation of which our host's wife and daughter, the latter an exceedingly comely young woman, still unmarried, took an active part. The ladies joined us quite naturally too in the fireside conversation after the meal, which was kept up far into the night. And, when we retired to rest, I noticed that there was only a reed screen separating the visitors from the family, while the household poultry also condescended to keep us company. A more primitive scene could scarcely be imagined, but I suppose that such people as these are content enough with their savage simplicity of life. Far removed from any contact with the world, they seemed to desire no closer acquaintance with it. They were indeed a little afraid of it for, as Zughaiyir told me in the presence of his ladies, it was rumoured among them—possibly a Turkish or Indian *canard*—that the aim of the English in Mesopotamia was to conscript all the men for labour or military service, and carry away the women for domestic servitude. I certainly did what I could to dispel such an idea, but the following day I encountered an exhibition of simplicity which altogether amazed me and seemed sufficient to account for any amount of credulity. I had brought with me a fair sum of rupees, to dole out as presents to the *mashhuf* men and others who rendered me service on the way, as also to the village children; for of course no payment for any hospitality would be accepted by our hosts. And at this stage of the proceedings I had only three silver rupees left, besides a wad of 10-rupee notes. A sum of five or six rupees would have been ample payment for the services in question (a rupee in those days was 16 pence gold), while my three rupees might have savoured somewhat of meanness, and of course there was no hope in the circumstances of converting a note into silver. So, making the best of a bad business, I offered my man a 10-rupee note, and was somewhat taken aback by his involuntary gesture of disappointment. "No, take it!" I said, half-thinking that he regarded it as over-payment for his services, "I am very grateful for all you have done for me." "But what is this?" he asked, perhaps thinking it was a spell or incantation. I explained to him that the scrap of paper was worth ten rupees, but he only laughed a little scornfully, probably thinking that I was trying to get away without any payment. From my point of view the situation was rather serious. So I pulled the three silver rupees out of my pocket, noticing a gleam of pleasure in his eyes as they fell on the silver coins. "Now, look here;" I said, "here are three rupees as you see, and here are ten as I tell you. Which will you have?" Without hesitation he put out his hand for the three coins, with an expression of something like gratitude. But, as he was tying them up in a corner of his head-cloth, I held out the note to him saying: "Look! You don't believe that this paper is worth ten of those coins! Now, you take the paper as well as the coins, and see if it isn't as I say the next time you go to Qurna or any other market." I do not know the sequel as I

never saw him again; but I have always harboured a hope that he did take the trouble to test the veracity of the only Englishman he had ever seen till then.

A narrow waterway led us through the middle of Baidha and across the island on which it is situated. The latter degenerated after a while into a reedy marsh, beyond which we plunged into a swamp of great tall reeds, 20 feet or more, which led us to the edge of a vast lake. After the toil of pushing through the reeds this provided good going, and we made satisfactory progress over the open water, interrupted here and there by extensive reed patches apparently floating on the face of the waters. For an interminably long time we went on like this, while the appearance of occasional *mashhufs*, coming up from Suwaib on the Shatt al 'Arab, cheered us with the thought that we could not have much further to go, though we had heard rumours among the Nawafil that the Bani Sukain tribe was on the war-path in this region, and we therefore proceeded warily without, however, being troubled by any alarms. The reeds again gave way to a great patch of open water, known as Haur al Ka'abi, beyond which we passed into the actual channel of the Suwaib river: presumably another section of the Nahrawan canal, or perhaps an old channel of the Tigris itself. At first the river was but a narrow stream meandering through a marsh; but gradually the reeds yielded to a sort of terra firma in which the Ruta river, evidently another old branch of the Tigris, joins the Suwaib, to make a respectable river of it, running between highish banks, well defined. And so we came to the limit of tidal influence, whence the broadened stream carried us through the gloaming to Suwaib village on the left bank of the Shatt al 'Arab, well below Qurna.

Here, as pre-arranged, my launch was waiting to take me down to Basra (on 19 January 1917); and I said goodbye to the companions of a very interesting and instructive excursion through one of the most primitive regions of Mesopotamia. In the heyday of the Nahrawan canal it had doubtless experienced a period of civilization and prosperity, from which it had relapsed, after Hulagu, into the primeval chaos of the days of Eden. More recently it has perhaps come into contact with a culture differing from but at least comparable with that of Babylon. It was something to have seen this world and its simple folk before that second transformation. It was something too to have been the first European, so far as I know, to have travelled by water from 'Amara to Basra without so much as seeing the Tigris. It was also my first experience of real exploration: the threshold, as it were, of the Arabian desert and a wandering life.

Note

The chapter from which the above is taken was written twenty years ago from my full notes of forty-one years ago.

Apart from the Tigris itself, the Nahrawan canal must have received replenishment from the Duwairij and Karkha rivers, both of which still contribute much water to the Haur al 'Adhim, the Haur al Huwaiza and the Haur al Ka'abi, which are the principal bodies of water in the area covered on this trip.

Distances (crow-fly): A. 4 miles from Nazal Muhammad to Baidha (north). B. 48 miles from Baidha (north) to Suwaib.

Time taken over A: 2 hours 45 minutes. Time taken over B: 22 hours 20 minutes.

TWO NEWLY DISCOVERED MANUSCRIPT MAPS BY CHRISTOPHER SAXTON

G. R. BATHO

CHRISTOPHER SAXTON, the Elizabethan map-maker, has received unusual recognition both in his own time and in ours.

> "The prince, the nobles, gentils, learned have
> Daygn'd him in court, in house, in study place"

his epitaph informs us; he was granted arms and received lands from the Crown, both signal marks of success for a cartographer. The late Dr. Edward Lynam wrote advisedly that "cartographical science was founded in England in 1574–9 by the publication of Saxton's magnificent engraved atlas of the country, the first national atlas in the world."[1]

Not surprisingly, Saxton has been the subject of close interest by students of the history of cartography. Yet he remains a dimly-delineated figure. The date of his birth is not precisely known; he himself in depositions to which two of his manuscript maps are attached makes conflicting statements as to his age which would give the year of his birth as either 1542 or 1544.[2] Sir George Fordham made out a good case for Dunningley, between Leeds and Dewsbury in Yorkshire, as his place of birth and his grant of arms refers to him as "Christopher Saxton of Dunningley, gentleman," but Wakefield has more recently claimed him as one of its sons.[3] His death is presumed to have occurred in 1611 but all that can be said with certainty is that he died after 1610, when he was named as a legatee in the will of his elder brother Thomas, and before 1626, when the will of his son, Robert, was proved.[4]

There is not a single reference by either Saxton or his patron Seckford to his atlas, though admittedly it is possible, as Fordham and Lynam have demonstrated, to follow the general progress of the survey for the atlas and of the printing of the maps. Knowledge of Saxton's extant manuscript maps has been even more hardly won. In 1928 Fordham could list only six manuscript maps known to be his and the work of the intervening thirty years has culled a mere seven more. Eleven signed maps are recorded and two unsigned maps have been identified as his work; of the signed maps one is lost and another survives only in an eighteenth century copy. The discovery of two hitherto unrecorded manuscript maps by Christopher Saxton among the papers of the Duke of Northumberland at Alnwick Castle is, therefore, exciting on account both of the cartographer's importance and of our relatively scanty knowledge of his career and work.[5]

Both the newly-discovered maps are estate plans of the manor of Spofforth, Yorkshire, which with the nearby manor of Topcliffe formed the nucleus of the estates of William de Percy, the founder of the fortunes of that great family in the time of William the Conqueror. In the early Middle Ages Spofforth was a principal seat of the Percys but by Saxton's time the Percys were living in their southern houses, Petworth in Sussex and (after 1594) Syon in Middlesex. By the will of Charles, the sixth Duke of Somerset, who had married the Percy heiress in 1682, the Percy estates in Sussex, Cumberland and Yorkshire passed to the Wyndham family; this is the explanation for a lawyer to the Percys in the early nineteenth century casting these Spofforth maps into an uncatalogued section of the family archives labelled "Manuscripts relating to lands of no further interest to His Grace," where they have remained ever since undetected, as other Saxton plans must surely remain in other repositories up and down this country.

Both the maps are drawn in coloured inks on paper and have the plain double

The earlier of the two newly discovered maps of Spofforth, Yorkshire, by Christopher Saxton (1606). Syon House MSS., Alnwick Castle, x.II.6, 34, no. 1

border commonly found on Saxton's manuscript maps, labelled in English with the four points of the compass in Saxton's characteristic firm Roman capitals with pronounced serifs. The earlier, smaller plan is titled:

> "A plat of the Mannor of Spoford Wherein all the demanes and wood grounds are Colored with yelowe, the Inclosures and Feildes Belonging to the towne are Colored With grene, the Common with red, and the confines Left White made by Christopher Saxton Anno Domini 1606."[6]

The later plan is titled:

> "A Plat of the Mannor of Spoforde Wherein all the Demanes and Wood groundes are Colored with Grene, the Inclosures and Common feilds With red, the Common with Yelowe, and the Freholders Left White made by Christofer Saxton Anno Domini 1608."[7]

A possible explanation of the change of colours between the markings of the two maps is that the later colourings were commonly adopted on the maps made for the Percy family in this period. The maps are both rectangular; the overall measurements of the earlier are 24¼ inches deep by 43 inches wide and of the later 47¼ inches deep by 58 inches wide. On both the scale is marked beneath a pair of extended compasses, as was Saxton's practice; the scale of the later map is given as 20 perches to an inch, that of the earlier as "This scale conteyneth 80 perches." On neither plan is there any indication of the length of a perch but it is known from an examination of nearly 200 other maps and plans dating from before 1700 and surviving in Percy archives that the Statute perch of 16½ feet was commonly employed by the surveyors to the family at this time.

Saxton worked rapidly and neither of the plans has any of the elegance of his printed maps, an elegance given them by the engravers and not by Saxton himself.[8] The earlier plan is in an unfinished condition; at the top left hand space has been ruled out for a key but it is unfilled and only the areas of the three great fields—Ribstone Field (92 acres), South Field (93 acres), and Crag Field (94 acres)—are given. The names of the owners of two neighbouring holdings have been added by another hand and the symbols for land use have been written in roughly. Though the plan has conventional thumb-nail sketches of houses, including the manor house, the names of the tenants are not given. On the later plan all this is corrected; the symbols are standardised to initial letters (A for arable, D for demesne, M for meadow, P for pasture, and W for wood) with ⊢, +, and ++ to mark the relative quality and areas are consistently given with the name of each tenant.

The 1608 plan of Spofforth gains an added significance from the fact that it is the latest known extant manuscript map by Saxton, though W. B. Crump has recorded the reference to a survey of the demesne lands of Liversedge, Yorkshire, by Christopher Saxton, "an experte surveyor," in a commission to survey the manor dated this same year.[9] The addition of these two maps to our list of Saxton's work underlines a point which Lynam was concerned to emphasize—the part which Seckford played in establishing Saxton's fame. His employment in 1569 to copy Michael Fitzwilliams's chart of Belfast Lough is testimony to his reputation before Seckford patronised him and bore the expenses of producing his atlas, but, as Lynam pointed out, "after he had completed his magnificent map of England, which Seckford commissioned, paid for and published in 1583, all his maps except the plans of Manchester (now lost) and Dewsbury, were estate maps" and, had it not been for Seckford, he might have remained no better known than Ralph Treswell or Israel Amyce.[10] Of his known estate maps, nine (including these two Spofforth plans) are of Yorkshire manors out of a total of twelve, and six of his plans were drawn in connection with disputes relating to lands in the Duchy of Lancaster, as when he surveyed Old Byland in 1598 by the consent of the special commissioners of the Exchequer and the solicitors to

both parties to the dispute and swore that the plat was truly done "to the best of his skill."[11] Unless a more intensive study of the early maps and plans lying in archive collections than has so far taken place demonstrates otherwise, it seems that for all his fame Christopher Saxton was essentially an estate surveyor working for the most part in his native county; certainly, apart from the work which he did under Seckford's auspices, his maps survive for a far more restricted area than those of—for example—Ralph Treswell of London the younger, whose surveying for the Percys alone was concerned with manors in Northumberland, Yorkshire, Sussex, Middlesex, Dorset and Somerset.

Besides their contribution to our knowledge of Saxton, the maps add to what is known of the estate management of the Percys in the period. They must have been commissioned by Henry Percy, ninth Earl of Northumberland (1564–1632), although there is no known reference to them in the household or estate accounts of the Earl, as frequently exists for the numerous other surviving plans which originated in that Earl's adoption of scientific estate management. The only other plan of Spoffoth in the ninth Earl's time is dated 1611 from a reference on an eighteenth century copy and is titled:

"The Platte of the Mannor of Spofforthe . . . made by Robert Norton."[12]

Norton does not mention Saxton's plans but clearly he would have had access to them and he also employs a scale of 20 perches to an inch. Norton's plan is larger and more elaborate than either of Saxton's; executed on vellum, it is 56½ inches deep by 71½ inches wide and is decorated with the arms, coronet and badge of the ninth Earl of Northumberland. Robert Norton, the well-known engineer and gunner whom the Earl may have met during his imprisonment in the Tower after the Gunpowder Plot (since Norton was in the royal service), was responsible for many of the estate maps bound with an extensive survey of the northern Percy manors carried out in the 1610's and 1620's as well as for plans of southern Percy manors in the same period. Saxton's maps of Spofforth were presumably part of the survey of the Earl's Yorkshire lands carried out by John Carvile, a solicitor to the Earl, in 1607, the terrier of which had to be bought back for the Alnwick archives in 1906.[13]

One can trace from these Spofforth plans the process of intensive exploitation of his estates in which the ninth Earl of Northumberland was engaged.[14] It was a process which had already led to disturbances among the tenantry at Spofforth in 1592.[15] As enclosure increased, the original pastures of the tenantry became heavily overloaded and their arable lands reduced to the point that they were obliged to supplement their meagre incomes by, for example, growing hemp and keeping ducks and geese, while agist rights in the Park were leased to capitalists, doubling the receipts from agist at Spofforth between 1608 and 1622; wood sales heavily reduced by 1606 the 1500 trees worth £196 which had been in Horsehouse Wood in 1577; and the tenants' custom of common in the Broade Park (at one shilling for cattle and two shillings for horses) noted on the Saxton plans was commuted for £50 by the Earl in 1618.[16] The fact that the Earl was an absentee landlord, himself incarcerated for sixteen years from 1605 to 1621, afforded no relief to the tenantry. When he wrote his 'Advice to his son' in 1609, the Earl laid it down as a first principle of estate management to "understand your estate generally better than any one of your officers"; that knowledge, he fairly claimed,

> "I have so explained and laboured by books of surveys, plots of manors, and records, that the fault will be your own, if you understand them not in a very short time better than any servant you have. They are not difficult now they are done, they are easy and yet cost me much time and much expense to reduce them into order; by them shall you direct and see when your causes proceed well or evil, slowly or swiftly."[17]

Saxton's maps of Spofforth were among the "plots of manors" designed to give the Earl this knowledge and the financial advantages which resulted from it.

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Lynam: Dr. Edward Lynam, 'The mapmaker's art: essays on the history of maps,' London, 1953.

P.R.O.: Public Record Office.

P.R.O. Maps TS.: 'Maps and plans in the Public Record Office, *c.* 1430–*c.* 1603,' 1954, typescript, Round Room of the P.R.O.

[1] Fordham: *T.S.M.*, 491; Lynam, 8.

[2] P.R.O. E 134 39 Eliz. E 14, and D.L. 4/51/59, q. Fordham: *Geogr. J.*, 51, 53.

[3] Fordham: *T.S.M.*, 357; *Geogr. J.*, **112** (1948), p. 256, where W. B. Crump q. J. W. Walker, 'Wakefield, its history and people' (Wakefield, 2nd edn., 1939), i. 867; *Geogr. J.*, **114** (1949), p. 236 where R. H. North discounts the ascription.

[4] Fordham: *Geogr. J.*, 54; *T.S.M.*, 491.

[5] A list of Saxton's known manuscript maps is appended to this note.

[6] Syon House MSS. at Alnwick Castle, X. II. 6. 34, no. 1, reproduced here.

[7] Syon House MSS. at Alnwick Castle, X. II. 6. 34, no. 3.

[8] See G. Manley, *Geogr. J.*, **83** (1934), pp. 308–14.

[9] *Geogr. J.*, **84** (1934), p. 178.

[10] Lynam, 63–5.

[11] P.R.O., E 178/2779, a memorandum by Sir Edward Stanhope who describes himself in P.R.O., D.L. 44/527, 37 Eliz., as " her Majesty's surveyor of the Duchy of Lancaster."

[12] Leconfield MSS. at Petworth (Mr. John Wyndham).

[13] Alnwick MSS. 88 A.

[14] See M. E. James, 'Estate Accounts of the Earls of Northumberland, 1562–1637' (Surtees Society, **163** (1955), pp. xxxv–lv, and G. R. Batho, *Economic History Review*, 2nd series, **9** (1957), pp. 433–50.

[15] 'Acts of the Privy Council,' XXII, 527.

[16] Fisher, E. J., 'Some Yorkshire Estates of the Percies, 1450–1650,' Leeds Ph.D. thesis, 1954, p. 83, pp. 122–41.

[17] Harrison, G. B., editor, 'Advice to his son,' London, 1930, pp. 75, 77.

APPENDIX: CHRISTOPHER SAXTON'S MANUSCRIPT MAPS

Maps marked **$** are unsigned; c. indicates coloured, p. paper, v. vellum

1569. Chart of Belfast Lough and the coast from Belfast to the sea. Endorsed "Baie of Cragfargus," signed "Christopher Saxton after Michael Fitzwilliams, 1569," v., c. (Lynam, 63).—Private collection, Ulster. Copy without title or date, not in Saxton's hand, P.R.O., S.P. 64/1, no. 10 (M.P.F. 77).

1590. Bayford and Goodmansterne, Kent: 'A Plate of the Manners of Bayford and Goodmanston in the Parish of Sittingbourne' (Lynam, pp. 65, 87, 89).—Collection of Cyril Kenney, F.R.I.C.S., F.S.A.

1592. Prest Thorpe, Bingley, Yorkshire: 'The plat of a howse and certen Landes in controversye in the parishe of Bynglay . . . which groundes are Colored with yelowe and the confines left white, made by Christofer Saxton An°. Dni. 1592,' p., c. (P.R.O. Maps TS., 16).—P.R.O., E 178/2746 (M.P.B. 30).

1593. Aveley, Essex: 'Plan of the Demesne Lands of the Mannor of Aluethly

belonging to St. Thomas's Hospital,' copy made 1782 (Lynam, p. 65).—Essex Record Office, D/Dth. 18.

1596. Manchester: plan of the town made for Dr. John Dee (Fordham: *Geogr. J.*, p. 51).—Lost.

1596.$ Isle of Axholme, Lincolnshire and Nottinghamshire, plan made in dispute between men of Haxey and Owston, Lincolnshire, and men of Misterton and Stockwith, Nottinghamshire, p., c. (Fordham: *Geogr. J.*, pp. 51–2; P.R.O. Maps TS., reproduced in G. Dunston, 'The rivers of Axholme,' London, 1909, p. 8, where it is incorrectly dated 1570).—P.R.O., E 134 39 Eliz. E. 14 (M.P.B. 16).

1598. Horbury and Netheron, Yorkshire: 'A plat of the Steaner in Controversye betwixt Horburye and Netherton being colored with grene, and the confines left white Made by Christofer Saxton An°. Dni. 1598,' p., c. (P.R.O. Maps TS., 17).—P.R.O., D.L. 31/9 (M.P.C. 9).

1598. Old Byland, Yorkshire: 'A plat of the parishe of Old Bylande Wherein all the Inclosed groundes are colored with red, The commons are colored wyth yelowe, The Defendants bounder betwixt Old Byland and Morton is drawen with a grene lyne; and the confines left white. Made by Christofer Saxton An°. Dni. 1598 per sacramentum,' p., c. (P.R.O. Maps TS., 17).—P.R.O., E 178/2779 (M.P.B. 32).

1599. Luddenden, Yorkshire: 'A plat of the course of Ludingden brooke with the milne gaites taken furth of the same from Luddingden Chappell to Luddingden foote, wherein the Confines of Midgeley is colored with yelowe, and the confines of Wareley is colored with red, made by Christofer Saxton, Anno Dni. 1599, p., c. (Fordham; *Geogr. J.*, p. 52; P.R.O. Maps TS., 17).—P.R.O., D.L. 4/47 (M.P.C. 111 (1)).

1600. Dewsbury, Yorkshire: 'A platt of the Towne of Dewesbury with the course of the River and waies from Maister Birkbye mill, to the over and nether myllnes of Dewesburie. Made by Christopher Saxton. Anno Domini, 1600' (Fordham: *Geogr. J.*, pp. 52–3; Lynam, p. 89; reproduced, *Yorkshire Archaeological Journal*, **21** (Leeds, 1911), plate 4).—Dewsbury Public Library.

1601.$ Luddenden, Yorkshire: 'A plat of Mychaell Foxcrofts groundes with his howse Milnes, goite, or dames Anno Domini 1601,' p., c. (Fordham: *Geogr. J.*, p. 53; P.R.O. Maps TS., 17).—P.R.O., D.L. 4/47 (M.P.C. 111 (2)).

1601. Snapethorpe Hall estate, Wakefield, Yorkshire: 'A plat of Mr. Pilkinton his landes, belonging to the old Haule & new Haule, in the parish of Waikfeild, Made by Christofer Saxton Anno 1601,' v., c. (W. B. Crump, *Geogr. J.*, **93** (1939), p. 180; reproduced in *Yorkshire Archaeological Journal*, **34** (Leeds, 1939), pp. 359, 360).—Unrecorded collection.

1606. Worsthorn, Lancashire: 'A perfect plat of the millnes and Water Courses in question betwixte John Towneley Esquire plaintiff and John Parker Gentleman and others Defendantes, made by Christofer Saxton the 23 of Aprill An°. Dni. 1606,' p., c. (Fordham: *Geogr. J.*, p. 53; Lynam, p. 89).—P.R.O., D.L. 4/51/59 (M.P.C. 112).

1606. Spofforth, Yorkshire: 'A plat of the Mannor of Spoford . . . made by Christofer: Saxton An°. Dni. 1606,' p., c.—Syon House MSS. at Alnwick Castle (Duke of Northumberland), X. II. 6. 34, no. 1.

1608. Spofforth, Yorkshire: 'A Plat of the Mannor of Spoforde . . . made by Christofer Saxton An°. Dni. 1608,' p., c.—Syon House MSS. at Alnwick Castle, X. II. 6. 34, no. 3.

SOME RECENT GEOLOGICAL DEPOSITS IN THE EGYPTIAN NILE VALLEY

K. W. BUTZER

SEVERAL YEARS AGO G. W. Murray[1] contributed a discussion to the *Geographical Journal* which marked the first successful attempt to sketch the Upper Pleistocene and Holocene climatic history of Egypt in a truly modern fashion. The wealth of personal observations and intimate knowledge of the material described reflected Mr. Murray's long years of experience in Egypt, since 1941 as Director of the Topographical Survey. During the winter of 1958 the present writer collected geological data in Middle and Upper Egypt which adds in some way to our present knowledge of Postglacial climates in that country.

Although the Recent, or Holocene, deposits of Egypt form but a minute fraction of the surface area, their significance for the inhabited riverain zone is paramount. Climate and sedimentation must have played as important a role in modelling the geographical environment in ancient times as they do today. For example, it is not at all obvious that the precious Nile alluvium has been distributed and laid down at a uniform rate since the close of the Pleistocene, as is widely supposed. These Holocene deposits in the Nile Valley are of aeolian and fluviatile origin: sand dunes, nilotic mud and wadi deposits.

The aeolian deposits.—Wind-borne sediments in the valley are more or less limited to the western margins, particularly between Gebel Deshasha (near Biba) and the monastery Deir el-Miharraq by el Qusiya, a stretch of over 80 miles. These sand fields are of considerable hindrance to cultivation. Their development is both complex and interesting, so that it is regrettable that, apart from reference to their existence, little attention has ever been paid to them. Firstly one can speak of an irregular line of marginal valley dunes lying exlusively upon Nile mud to a width of one half to two miles between Deshasha and a point about three miles south of Balansura (west of Abu Qurqas). After a small interruption similar dune fields occur between Tuna el Gebel (west of Mallawi) and Dashlut (west of Dairut), and again between Nazlet Bawit (west of Sanabu) and el-Miharraq. In contrast to the dunes upon the Pleistocene gravels west of the desert margin, these are to a fair extent fixed by vegetation deriving its moisture from the ground-water. Although the fields between Deshasha and Balansura can only be classified with difficulty as generally transversal arrays running parallel to the border desert-alluvium, those between Tuna and Dashlut are developed as specific geomorphological forms. Three rows of 10 feet high transversal dunes run NNE.–SSW. while another line abuts the desert in the lee of the Pleistocene gravels. In the Meir area, between Sanabu and Qusiya, two immense longitudinal dunes of four miles in length are blown up in the lee of the steep limestone scarp running NNW.–SSE. All these dunes overlie nilotic sediments and were apparently deposited during the last few centuries.

From behind the Black Hills due west of Beni Mazar a chain of NNW.–SSE. longitudinal dunes, generally averaging one or two miles in length, extends over 30 miles across the desert surface to the nummulitic headland a little south of Balansura. These deposits have no direct continuation north-westward while they merge with the marginal valley dunes south of Minya, forming a great field of barchans north of Balansura. These fields, and the minor longitudinal leeward dunes abutting from the scarp here and there, are mobile and moving across the Pleistocene gravels.[2] It

[1] "The Egyptian climate: an historical outline." *Geogr. J.*, 117 (1951), pp. 422–34.

[2] Both the Western Desert and the marginal valley dunes are shown on the geological map of Middle Egypt (between Fashn and Qusiya) in Butzer, "Contributions to the Pleistocene geology of the Nile Valley," *Erdkunde*, 13 (1959) pp. 46–67.

appears that the barchan fields north of Balansura, which merge with marginal dunes there, are, in their present position, partly related to the sub-recent aeolian deposition on the adjacent alluvium indicated by the surface marginal dunes.

From a number of exposures between Dashlut and Tuna the marginal dunes in that area generally overlie 8 to 12 inches of Nile mud and, below that, some 6 feet of further aeolian sand. The latter rests upon alluvium and nilotic sands often attaining 6 feet, and then again upon at the very least 15 feet of wind-borne sand. The major layer of alluvium appears to be Roman.[1] In other words two layers of aeolian sand were deposited in late and post-Classical times, the Upper Younger Dunes representing the present surface deposits, the Lower Younger Dunes the upper buried ones (Fig. 1). The latter can be found under alluvium in exposures several miles west of the surface dunes, indicating greater aeolian activity in an intensified desert climate at the time. Towards the east they are also subdivided by interdigited bands of alluvium. The Older Dunes, underlying the mud of Hellenistic age, represent a long period of deposition, possibly 1000–2000 years. Several erosional surfaces invariably occur within the profiles and the base was never observed. These former

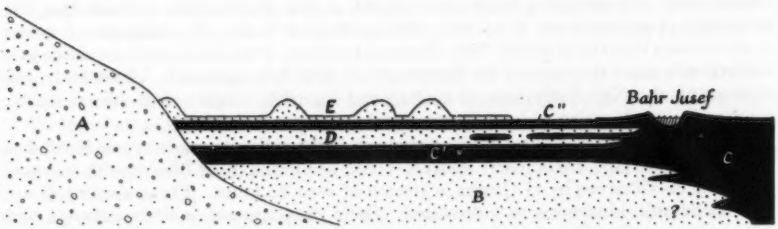


Fig. 1. Idealized profile of the Marginal Valley Dune generations in western Middle Egypt (between Dashlut and Tuna el Gebel: A. Pleistocene gravels; B. Older Dunes; C. Holocene alluvium, C' Roman age, C'' Islamic age; D. Lower Younger Dunes, locally subdivided (later Roman to early Islamic); E. Upper Younger Dunes (modern)

dunes also extended well west of the surface ones and likewise imply greater aeolian activity in pre-Hellenistic times. A lower limit can be deduced from evidence at the site of Hieraconpolis in Upper Egypt. There a Predynastic cemetery in Palaeolithic silts was later wind-eroded, exposing the burials while the silts and foreign sand were laid down in false-bedded deposits covering 2,500,000 sq. ft. a little in the lee. Other indications would indicate that slightly more abundant rains occurred from Neolithic right down to Vth Dynasty times,[2] so that an estimation of 2350–500 B.C. for the period of formation of the Lower Dunes would not seem unreasonable.

Another Recent phase of accelerated aeolian activity can be deduced from the work of Miss Caton-Thompson and Miss Gardner[3] in the Fayum depression, where

[1] Dr. W. Kaiser identified numerous pottery sherds at one section in the main alluvium horizon and base of the overlying sand as Roman. This contained brown rilled and a coarse red ware. The archaeological material will be published, along with a geological description by the writer, in *Mitt. deut. Archäol. Inst. Cairo*, **17** (1959).

[2] Butzer, K. W., "Das ökologische Problem der neolithischen Felsbilder der östlichen Sahara." *Abhl. Akad. Wiss. Liter. (Mainz), Math.-Naturw. Kl.* 1958*a*, 20–49, Nr. 1; "Quaternary stratigraphy and climate in the Near East." *Bonner Geogr. Abhl.*, 1958*b*.

[3] Caton-Thompson G. and E. W. Gardner, "Recent work on the problem of Lake Moeris," *Geogr. J.*, **73** (1929), pp. 20–60; also *Bull. Inst. d'Egypte*, **19** (1937), pp. 243–303. It may be noted that the sand lenticle found by K. S. Sandford and A. J. Arkell ('Paleolithic Man and the Nile Valley in Nubia and Upper Egypt,' Oriental Inst. Publ., University of Chicago, 1933, p. 47) in the Sebilian Silts at Armant indicates similar arid spells in Upper Pleistocene times.

desiccation and severe wind-scour followed upon the Middle Sebilian and before the recreation of the pre-Neolithic lake at 206 feet R.L. With radio-carbon dates of 4440 and 4144 B.C. for the early Neolithic lake, it may be that the previous arid phase ended about 5000 B.C.

The valley alluvium.—The deposition of Nile mud is generally believed to have begun after the Upper Pleistocene degradation of the Nile Valley, when the river bed rose in response to the early Postglacial rise in eustatic sea level. The silts deposited before this in Upper Levalloisian and Lower Sebilian times are, however, fine, slightly sandy deposits from annual floods of Blue Nile provenance, only a little different from modern alluvium. It seems that the subsequent Nile degradation only interrupted further deposition until the river gradient was less steep. As can be seen from numerous bore-hole profiles, the earliest aggradation corresponding to a rising base level of erosion was not nilotic mud but mica-bearing, fine gravel and sands which lie 10 to 30 feet thick below the alluvium in Middle and Upper Egypt.[1] This presumably post-Sebilian filling is certainly post-Upper Levalloisian as the high percentage of Blue Nile minerals (*e.g.* pyroxenes) never occurs in earlier deposits.

Today the alluvium of the central valley averages 32 feet between Cairo and Minya, 28 feet between Minya and Qena, and 22 feet between Qena and Aswan. The late John Ball [2] calculated an annual deposition of 0·0405 inches of mud for the basin lands of the valley before the Aswan dam came into operation. Assuming a steady rate of deposition the present alluvium dates back to about 4600 B.C. in the southern part and to 7600 B.C. in the northern part of the valley. This would be understandable as a gradual response to a rising sea level first noticeable in the Delta and progressing slowly upstream.[3] The calculated mud rise comes very close to the archaeologically estimated rise of 4 inches in the basin lands of the valley. However, it would be presumptuous to assume that neither the sea level (and the base level of erosion) nor the Blue Nile flood volume fluctuated a little in the course of the last 7 millennia. In an earlier paper it was suggested that the sea level reached a maximum of +12 feet (*c.* 3300–3000 B.C.) dropping to a stand at +6 feet (*c.* 2500–1500 B.C.), and probably attaining a stand at below modern sea level in Graeco-Roman times.[4] Similarly A. J. Arkell [5] could show that the Blue Nile flood level was at least 12 feet higher in Mesolithic Khartoum (*c.* 4000 B.C.), while the annual fluctuations of the Islamic era are well known. It therefore appears likely that the rate of deposition was very much higher before 3000 B.C. than it is today, something confirmed archaeologically as three-fifths of the alluvium were already deposited during some 4000 years before Old Kingdom times. For example, G. W. Murray kindly informed the writer that 3m. of mud were deposited at Hieraconpolis before the reign of Pepi II (*c.* 2250 B.C.), compared with only 2m. since that date.[6]

[1] See the bore-profiles given by Sandford, 'Paleolithic Man and the Nile Valley in Upper and Middle Egypt,' Oriental Inst. Publ. 18, Chicago 1934, pp. 103–4; also Sandford's Fig. 25.

[2] Contributions to 'The geography of Egypt,' Cairo, 1939, p. 163 *et seq.*

[3] Recent radio-carbon dating by the Cambridge Laboratory confirms a rise in world sea level by 150 feet between 8750 and 3500 B.C. (H. Godwin, R. P. Suggate and E. H. Willis, "Radio-carbon dating of the eustatic rise in ocean level." *Nature*, **181** (1958), pp. 1518–19).

[4] Butzer, K. W., "The 2m. raised beach near El Alamein, Egypt." *Actos*, V. Congreso INQUA, Madrid-Barcelona (1957), in print; also 1958*b*, *op. cit.* pp. 37–8.

[5] 'Early Khartum,' Oxford, 1949, pp. 109–10.

[6] There has been considerable speculation about a so-called 20m. aggradation at Maadi in Neolithic times (*cf.* I. Rizkana, "Centres of settlement in prehistoric Egypt in the area between Helwan and Heliopolis," *Bull. Inst. Desert*, **2**, 2 (1952), pp. 117–30. The writer (1958*b*, *op. cit.*, pp. 66–7) has already given grounds why the mineralogical statistics could just as well be cited as evidence in favour of a Middle Palaeolithic dating. He has also had opportunity to examine the greater part of the prehistoric sites of Egypt without, however, having found a trace of evidence in favour of Neolithic mud deposition higher than the present flood level. G. W. Murray has likewise communicated to the author that further such evidence

From the alluvial deposits in Middle Egypt it appears as if sedimentation was accelerated during the first few centuries of our era, which was possibly due, in part, to the rise to present sea level beginning about the same time. The 6 feet of mud dating from this time (Fig. 1) took at the most 600 years to form, judging from the uniform pottery sherds occurring throughout the datable section near Tuna el Gebel. But 6 feet would theoretically require some 1800 years deposition, so that the rate of sedimentation must have been three times as great as today in Hellenistic times. This figure may be distorted a little, due to the lateral shifts of the Bahr Jusef which are indicated by the fluviatile sands, rich in organic matter, to be seen in countless buried alluvium sections in western Middle Egypt. Whether these shifts were natural, *i.e.* due to stronger floods inducing stronger meandering of this Nile arm, or due to human interference, is uncertain. There are also geomorphological indications that the Bahr Jusef flowed directly east of the desert gravels in classical times, something closely reflected in the flourishing conditions of human settlement in the western valley at the time. Graeco-Roman, and apparently only remains of this age, are scattered profusely upon the low desert surface wherever one goes. This also fits in with the aeolian activity in preceding and subsequent times. It should be pointed out, however, that pottery sherds can "slip down" through a layer of seasonally viscous Nile mud in the course of time, so that Roman sherds found throughout a horizon may only date the uppermost part.

The Lower Younger Dunes are occasionally intercalated with a mud layer containing numerous sand lenses in its upper part, suggesting a westward shift of the Bahr Jusef in early post-Classical times. Arab authors mention the Bahr Jusef arm as beginning north of Asyut in 871, 1245 and 1441 but in 871, 900 and 1153 Ibn abd el Hakim, Ibn Serapiun and Idrisi respectively state that the Nile arm begins at Soul (Sohag). Ibn Khaldun in 1405 merely repeats Idrisi. From the continuous canal still running between Sohag and west of Dairut at the time of the French Survey (1799–1801) it appears that this former alternative branch ran somewhat west of the present Bahr Jusef.[1] This would give a ninth–twelfth century date for the "Branche de Sohag" and the brief interruption of the Lower Younger Dunes.

Somewhere in more recent times the 8–12 inches of alluvium everywhere covering the Lower Younger Dunes were deposited, apparently during a period of higher floods. In 1441 the Bahr Jusef source was already given as Dairut el Cherif as it has been ever since the eighteenth century. But el Zahiri in 1467 and the seventeenth century map of P. Vander (Amsterdam) both show the river arm commencing at Menha or Mounha, a now unknown site between Manfalut and Asyut. It appears that this arm likewise ran to Meir and along the Hod el Dalgawi drain to join the present Bahr Jusef at el Badraman, also west of the present river. Even since 1800 the Bahr Jusef has shifted a few miles eastward between Maghagha and Lahun. The Upper Younger Dunes apparently moved across the fifteenth–seventeenth century alluvium once more after A.D. 1700. For the Islamic era it is more or less certain that the Bahr Jusef shifts were natural and due to stronger or weaker Nile floods as the accounts of Nabulsi (1245) would have us suspect. These would be a reflection of rainfall fluctuations in the Blue Nile basin.

Local fluviatile deposits.—Lastly the wadi and other local deposits of the Nile Valley deserve mention. These are, of course, intimately associated with periods of more frequent occasional rains, either in the hilly country or as a southward shift of the etesian rainfall belt. For the Neolithic and Predynastic period G. W. Murray and the writer have already given detailed descriptions of the various indicators of a slightly

is also unknown to him. In view of the somewhat incomplete and unconvincing publication of the Maadi-Turah bores, we incline to consider the assumption unwarranted until better supporting data are available.

[1] These features, as well as the now abandoned canals west of Dairut, are shown on the geological map, referred to in footnote 2, p. 75.

moister "subpluvial" climate.[1] It may be of interest here to discuss the question of classical or later rainier periods.

Despite careful search and study of countless Roman ruins in the valley it was not possible to find any indication whatever of more frequent rains at that time. However there are suggestions for a moister period in post-Classical times, which may well coincide with historical evidence of a moist interval in Asia Minor during the ninth to tenth centuries.[2] Thus, the Middle Eocene limestone debris left after the demolition and requarrying of a limestone building at Oxyrhynchos (El-Bahnasa) is cemented to a depth of 6 inches by dissolved lime and bands of crystalline gypsum. Such a resistant breccia as this requires more than air moisture for formation, implying some rainfall after the requarrying of the building stones, probably in early Islamic times. At Acoris (Tehna) some 5 feet of well stratified and well assorted fine material were deposited behind a brick barrier after the abandonment of the city in Coptic or early Arab times. Such deposits are not brought down by present spates which carry a heterogeneous mass of rubble with them. Similarly at Hebenu, former capital of the 16th Upper Egyptian Nome, similar thick deposits were laid down in a small depression in front of an irrigation dam, after the abandonment of this part of the town in post-Coptic times. Scanty as the evidence is, it does suggest a brief interval with some rains, possibly contemporary with the brief cessation of aeolian activity and with the moist interval in Asia Minor about A.D. 900.

Summary and conclusions.—Summarizing the geological deposits and associated climates of the Holocene it seems possible to add somewhat in detail to that first successful study by G. W. Murray. The dating remains very approximate of course.

?16,000–5000 B.C. Arid with intensified aeolian activity. Probably a brief interruption about 9000 B.C.

5000–2350 B.C. Moister than today ("Neolithic subpluvial").

2350–500 B.C. Arid with intensified aeolian activity. Older Dunes in Middle Egypt.

500 B.C.–A.D. 300. Accelerated deposition of Nile mud. Higher floods. Locally arid.

A.D. 300–800. Arid with intensified aeolian activity. Lower Younger Dunes (I).

800–1200. Higher Nile floods. Locally slightly moister at first.

1200–1450. Arid. Lower Younger Dunes (II).

1450–1700. Higher Nile floods.

Since 1700. Recent (Upper Younger) Dunes in Middle Egypt and present-day conditions.

[1] Murray G. W. (1951), *op. cit.*; K. W. Butzer, 1958*a*, 1958*b*, *op. cit.*

[2] Butzer, K. W., "Der Umweltsfaktor der grossen arabischen Expansion." Saeculum, *Jhbh. f. Universalgeschichte* **8** (1957), pp. 359–71.

MAPPING IN JAMES I LAND, VESTSPITSBERGEN

F. B. KENNEDY

ENGLISH WHALERS, who first visited Spitsbergen in the first decade of the seventeenth century, called the main island of Vestspitsbergen James I Land. The name was never widely used and had fallen completely into disuse until, after his visit in 1897, Sir Martin Conway[1] restored it to that portion of the island north-west of Isfjorden. De Geer in his map of 1913 also used the name. The old title has now been recognized by the Norsk Polarinstitutt, the Norwegian organization which has the responsibility for mapping Spitsbergen, and they have applied it to the area bounded by Kongsfjorden and the head of Ekmanfjorden in the south, and Vestfjorden (off Wijdefjorden) and the head of Woodfjorden in the north.

In the centre of James I Land is a region of plateau ice at a general elevation of 2000 feet. Glaciers flow down from this towards the sea, intersected by a series of mountain ridges. At the beginning of summer the glaciers are snow-covered and travelling by ski and sledge is simple, but by the beginning of August the snowline has receded almost up to the plateaus so that meltwater streams and bogs and ice hummocks and crevasses make journeying unpleasant.

It is an ideal place for the apprentice Arctic explorer as access to Spitsbergen is easy and the climate not rigorous, and there are still some enticing holes in the map. These interested the author, who was the surveyor of the Queen's University of Belfast Spitsbergen expedition in 1957. The four-man inland party reached the Holtedahl ice plateau via the Sefstrømbreen from Ekmanfjorden, and spent three weeks in topographical and geological mapping and climbing. The return to the coast was by way of the Kongsvegen glacier and Kongsfjorden.

Existing maps.—Coastlines and features visible from the sea are well represented on naval charts. The Norsk Polarinstitutt is publishing a series of maps of Spitsbergen (scale 1 : 100,000), but publication has not yet reached farther north than Isfjorden; survey work is, however, being carried on there, as a good-class triangulation network covering the south, west and north boundaries of James I Land exists, and the area was overflown for aerial photography in 1938.

The best map is that of the Isachsen expedition of 1909–10[2] (scale, 1 : 200,000). This is based on that party's work and includes surveys by De Geer, Nathorst, Bruce, and the Prince of Monaco's expeditions, and Admiralty charts. James I Land is completely mapped west of the 13° E. meridian, but east of this and particularly east of the 14° E. meridian there are large unmapped areas.

Isachsen's survey.—The Isachsen map, on a conic projection, is built up on two base lines. These were measured on Prins Karls Foreland and on Reinsdyrflya, which is the peninsula north-west of Woodfjorden, and separate triangulations were set up. Small instruments were used and observations made on snow or rock cairns. The ten mile wide Holtedahl ice plateau halfway between the bases prevented the systems from being properly integrated. The connection was made by the intersection of two common stations into each network. The difference in the distance between the base lines (120 miles), calculated through the trigonometrical network, and from astronomical observations, was 400 metres in latitude and 180 metres in longitude.

During our consideration of the Isachsen data early in 1957 it was realized that the

[1] An exploration in 1897 of some of the glaciers of Spitsbergen.—*Geogr. J.*, **12** (1898), pp. 137–58.

[2] *Geogr. J.*, **45** (1915), p. 272.

Isachsen network would provide a good base for a survey, particularly if it could be related to the Norsk Polarinstitutt trigonometrical system. Colonel D. R. Crone compared Isachsen's trigonometrical data with that available from the Norsk Polarinstitutt. The descriptions in the two lists of two stations near Woodfjorden and one on Ekmanfjorden suggested that the same points had been used as stations in both networks. Assuming that both grids were rectangular, from two of these stations it was found that a scale factor of 0·998686 and a swing of bearing of $+2^{\circ}\ 59'\ 12''{\cdot}5$ applied to the Isachsen network, would refer it to the Norsk Polarinstitutt grid. This conversion was checked on the third point and the result agreed to within 3 metres. Using this conversion values of coordinates on the Norsk Polarinstitutt grid were calculated for Isachsen's stations in James I Land.[1] The Norsk Polarinstitutt grid is on the Gauss-Krüger transverse conformal cylinder projection on the International spheroid.

In the field, a check on this conversion was obtained at a point, the position of which was found by resection from five Isachsen and two Norsk Polarinstitutt stations.

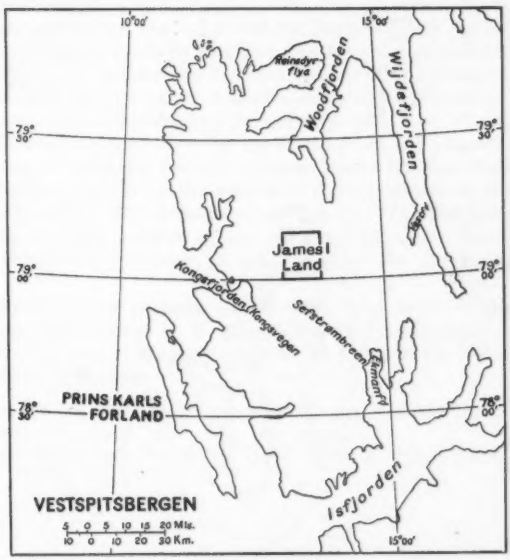


Figure 1

Work in the field.—On reaching the Snøfjella, north of the Holtedahl plateau, the fine weather which had prevailed on the journey gave way to the more usual misty conditions. Observation was possible on five days out of nineteen spent in this area, so that to allow as many stations as possible to be set up during the fine weather positions were chosen on the ice cap rather than on mountain tops. As the work was being done in the "gap" between the two Isachsen trigonometrical systems, and from most stations no trig points in the north were visible, some difficulty was found in obtaining good resected positions, but a sun azimuth and a base line, measured by a 300 foot steel band, enabled a good fix to be made for one group of stations, and the remainder were tied in to these.

The cairns marking Isachsen's stations have by now disappeared. Most of the stations, however, were on sharply topped mountains, easily recognized, so that their positions on the ground can be found to the same order of accuracy as their known positions on the grid. Observations to points in Isachsen's northern triangulation series from the one station, Wiechertfjellet, from which these were visible disclosed a difficulty. These observations did not close with the position of the station, which was calculated from sights to the south and checked from photographs taken at the station. The discrepancy is about 4°. No explanation has been found for this, other than that of an observational blunder.

[1] A table of these values will be deposited with the Royal Geographical Society.

The instrument used was a Wild T O compass theodolite. This is a lightweight instrument, the circles of which can be read to one minute of arc, but the stand supplied with the instrument is very little lighter than normal weight. A special stand was designed from one inch wide channel section aluminium. This was found very useful in the conditions met, but it is hardly stable enough for ordinary use. The snow cover on the ice cap is very soft in summer, hence a special technique was

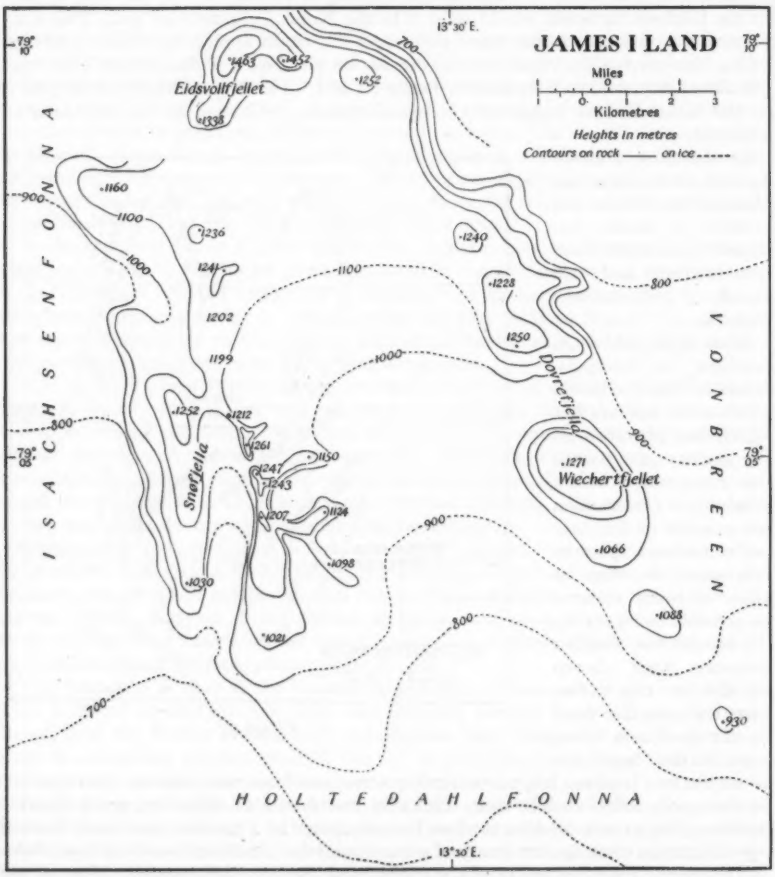


Figure 2

necessary for setting up the theodolite. The feet of the light tripod were "floated" on ration-box lids laid on the snow surface, which had been consolidated as much as possible. These lids were 2 feet by 1 foot in area and 6 inches deep. The method would not be suitable for supporting more accurate theodolites as slight alterations in level were noticed as the surveyor moved round the instrument, and a watch had to be kept for alterations of the readings indicating sinking of the "pontoons."

The 1957 map (see Fig. 2).—This was based on the theodolite stations, from which

points of detail were intersected, and heighted from vertical angle measurements. These points were used to control photographs taken at the theodolite stations by 35 mm. film camera. Further rounds of photographs were made from some of these points of detail, and from other points located by prismatic compass bearings and heighted by clinometer observations. Contours on the glaciers were interpolated from aneroid barometer and clinometer observations made on the compass and sledge-wheel route traverse. Plotting from the photographs was not found laborious and good agreement was obtained for heights found from the photographs. This method is quicker on the ground though less certain than plane tabling; it is better suited to Spitsbergen temperatures and enables the fullest use to be made of fine weather. The scale used in plotting was 1 : 50,000, on the Norsk Polarinstitutt grid. Place-names were taken from the official list.[1] A large portion of the area mapped in 1957 is represented on the Isachsen map, but as this area was not visited in 1909–10, and the map of that date drawn up from long-range photographs, only a rough outline of the topographical features is given. Agreement was found with the heights of the principal tops and the profile of the ice plateau as given by Isachsen, but the representation of lesser valleys and ridges needed much improvement. Improvement in this respect is needed in most parts of the map of James I Land. A particularly striking omission is the south-west summit of Vasafjellet, a beautiful rock peak of 3450 feet.

Future opportunities.—Opportunities for surveying expeditions are still plentiful in James I Land, for as well as the doubtful eastern border of Isachsen's map there exists a large area of unmapped country from the eastern Holtedahl plateau to the boundaries of James I Land, lying between Isachsen's map and that compiled from several Cambridge expeditions.[2] The scenery of ice plateau and round snow-covered hills will provide interesting problems of surveying, besides the initial problem of access.

Acknowledgements.—The author wishes to thank Mr. Peter Robson, leader of the inland party of the expedition, and Colonel D. R. Crone, lecturer in surveying at Queen's University for their advice and encouragement; also Dr. Orvin of the Norsk Polarinstitutt, who was always ready to assist.

[1] 'The place-names of Svalbard'—'Skrifter on Svalbard og Ishavet No. 80.' Norges Svalbard-og-Ishavet-undersokelser, Oslo, 1942.

[2] Harland, W. B., "Cambridge Spitsbergen Expedition 1949," *Geogr. J.*, **118**, 3 (1952), pp. 309–33.

THE RECESSION OF AN ICELANDIC GLACIER

F. G. HANNELL AND I. Y. ASHWELL

THE ACCUMULATION OF QUANTITATIVE DATA concerning rates of glacier recession in Iceland began in 1930, and figures relating to a few glaciers have been made available.[1] However, there is no such information for Hagafellsjökull Eystri and Hagafellsjökull Vestri, which are located at the south-eastern corner of Langjökull, nor, so far as is known, have Icelandic workers in this field made any measurements in that area. This paper constitutes an attempt to deduce, from an examination of maps and aerial photographs of different date, quantitative data relating to the recession of Hagafellsjökull Eystri (E. Glacier) throughout the period 1934–56 and also during certain subdivisions thereof. A quantitative assessment is also made of the mean annual rate of lowering of the glacier surface during the interval 1950–6, and the resulting figure would seem to contribute to our knowledge of the life-history of dirt cones, at least in this particular area.

The Hagavatn overflow-channels: Hagavatn (Fig. 1) is a typical ice-dammed marginal lake which came into existence when the building of Lambahraun, a post-glacial but pre-historic lava cone, blocked the drainage along an older north-east to south-west valley. The lake is dammed along its north-eastern side by the E. Glacier and it has at different times overflowed across the Jarlhettur range through four separate channels. A map prepared by the Icelandic cartographer Gunnlaugsson in the summers of 1834 and 1835[2] shows that Hagavatn, having abandoned its first outlet ("Mosaskard"),[3] was at that time draining through channel 2 ("Fagridalur").

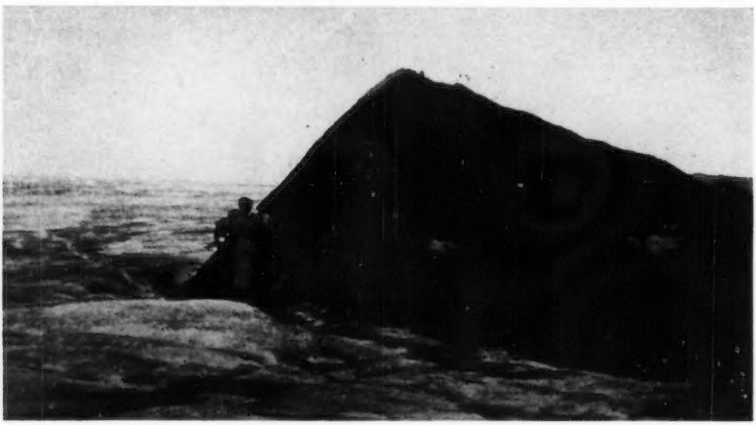
Since the heights of the four channel entrances decrease successively from south to north, flooding of the lowlands to the south will occur when the snout of the E. Glacier is receding, but not when it is advancing. Floods resulting from outpouring through channel 3 ("Leynifoss") occurred in 1884,[4] 1902[4] and 1929.[4, 5, 6, 7] Thus, prior to 1884, the snout of the E. Glacier must have been receding, but this phase must have been followed by a period of advance since subsequent recession resulted in another flood through channel 3 in 1902. Likewise, the glacier snout must have advanced again after 1902, otherwise recession could not have occasioned a third flood through channel 3 in 1929. By 1939 the glacier had further receded to such an extent that on August 13 of that year channel 4 was uncovered. Consequently, there was another disastrous flood over parts of the southern lowlands,[8] and on this occasion the partial draining of the lake exposed a fine series of varves, particularly near the new south-eastern shore of Hagavatn.[9]

The precise dating of the Hagavatn floods has, therefore, already made it possible to reach generalized conclusions concerning the fluctuations of the E. Glacier,[4] but no quantitative data have hitherto been available.

The recession of the E. glacier: a quantitative assessment: The Hagavatn area was mapped on a scale of 1:20,000 by the Cambridge University Expedition of 1934,[10] and in August 1950 it was re-mapped on a scale of 1:25,000 by the Durham University Exploration Society.[11] Vertical air photographs of the area taken on 23 September 1945, at a scale of approximately 1:45,000, were made available to the authors through the courtesy of Hr. Agúst Bödvarsson of Landmaelingar Islands, Reykjavik. One of the tasks undertaken by the British Schools Exploring Society's 1956 Expedition to central Iceland was the re-mapping of the Hagavatn area on a scale of 1:25,000.[12] It was hoped that by transferring to this map the positions of the E. Glacier snout in 1934, 1945 and 1950, it would be possible to present a quantitative assessment of the mean rate of recession of this glacier throughout the period 1934–56, as well as during the separate subdivisions thereof.

Hagavatn area, Sept. 1956; vertical air photographs taken shortly after completion of map on which Fig. 1 is based. Kindly made available by Hr. Agúst Böðvarsson, Landmaelingar Islands, Reykjavik; published with approval of the National Research Council of Iceland

Mosaskard (Channel 1 in Fig. 1) from the east



Dirt cone at Point C in Fig. 1

Outlet from Hagavatn in September 1956 (Channel 4 in Fig. 1)

PHOTOGRAPHS TO ILLUSTRATE POINTS ON FIGURE 1, PAGE 85

The 1956 map was completed in August and September of that year by the expedition's survey party of twenty-three persons, including two Royal Engineer officers. A third-order triangulation network, observed by Wild T2 theodolites, was originated by inaccessible base observations to two Icelandic trigonometrical stations, and all detail was mapped by plane-table with a contour interval of 20 metres. The density of the triangulation network was such that errors in plane-tabling were very closely controlled, and the measure of agreement along the overlapping

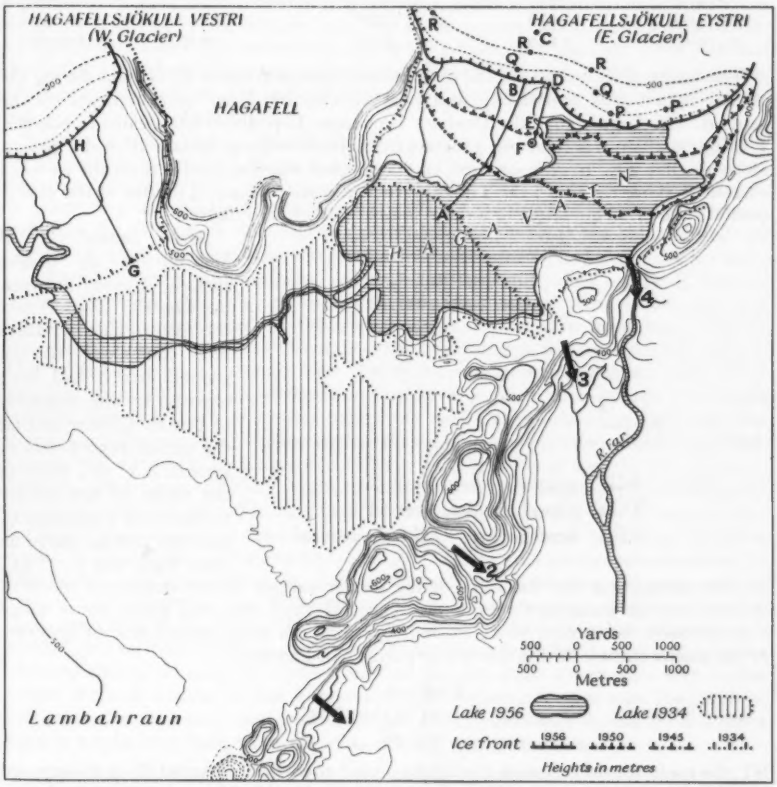


Fig. 1. Hagavatn area

margins of the five plane-table sheets was such as to suggest that errors were nowhere in excess of the plottable error which, on the scale of 1:25,000, amounted to *c.* 6·5 metres.

The positions of the E. Glacier snout in 1950, 1945 and 1934 were then transferred to a full-scale copy of the 1956 map, and the result is indicated on a reduced scale in Figure 1. An arc AB was then drawn on the map in such a way as to be at right angles to the successive ice fronts and as free as possible of any interference caused by Hagafell and Hagavatn. Measurements off the map along this arc provided such data pertaining to the recession of the E. Glacier as are presented in Table 1.

TABLE 1

Recession of the E. Glacier in metres

Period (*a*)	*Total recession* (*b*)	*Accuracy*[13] (*c*)	*Mean annual recession* (*d*)	*Extreme limits* (*e*)
1950–56	500	±20	83	80–87
1945–50	440	±43	88	79–97
1934–45	600	±50	55	50–59
1934–56	1540[14]	±27	70[14]	69–71

The figure of 83 metres for the mean annual recession of the E. Glacier during the period 1950–6 was remarkably well substantiated by direct measurements on the ground. In August 1950 the Durham University Expedition left a cairn in position F (Fig. 1), which was then 102·7 metres from the ice edge as measured on the ground along the line FE. In August 1956, the same cairn was 600 metres from the ice edge measured along the line FD. Thus the total recession of 497·3 metres in the 6-year period 1950–6 is equivalent to a mean annual rate of 82·9 metres.

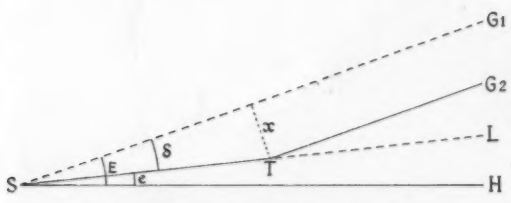


Fig. 2. SG1*: glacier surface, year Y*
TG2*: glacier surface, year* (*Y*+1)
STL*: land surface;* SH*: horizontal*

Mean annual rate of lowering of the glacier surface, 1950–6*:* Between the line ED (Fig. 1) and the eastern side of Haga-fell, the slope of the ground which had been exposed by the recession of the E. Glacier during the period 1950–6 was in general *c.* 1° 25′, whereas the slope of the glacier surface over a distance of 500–600 metres above its 1956 limit was *c.* 5° 43′. On the assumption that the slope of the glacier surface in the vicinity of its snout did not change significantly between 1950 and 1956, the data given above allow a quantitative assessment to be made concerning the mean annual rate of lowering of the glacier surface during this 6-year period. In Figure 2:—

$$\begin{aligned}\delta &= E - e \\ &= 5^\circ\,43' - 1^\circ\,25' \\ &= 4^\circ\,18'\end{aligned}$$

ST, the mean annual recession during the period 1950–6 as measured along the exposed land surface = 82·9 metres. Therefore x, the mean annual amount by which the surface of the glacier was lowered during the same 6-year period

$$\begin{aligned}&= ST \sin \delta \\ &= 82{\cdot}9 \sin 4^\circ\,18' \\ &= 6{\cdot}2 \text{ metres.}\end{aligned}$$

This figure can be roughly corroborated from an examination of contours near the snout of the E. Glacier on the 1950 and 1956 maps. The points P (Fig. 1), which in August 1956 were on the 460 metre contour, were in August 1950 on the 500 metre contour. Similarly, the points Q and the points R had also been reduced in altitude by 40 metres during the same 6-year interval, and this corresponds to a mean rate of lowering of the surface of 6·7 metres per year.

Dirt cones on the E. Glacier: In the course of several journeys across the E. Glacier, many dirt cones were seen including, in particular, one which was located at point C in Figure 1. This remarkable specimen was 15 feet (4·6 metres) in height, and its core of solid ice was covered by a thin layer of fine volcanic material which was very dark in colour. Its westward, southward and northward-facing sides sloped at angles of 45°–48°, but the slope of its eastward-facing side was only 20°. The finding of a cone of this height occasioned some surprise. Bout, who made a detailed study of the dirt cones on the southern side of Langjökull in 1950 and on Hofsjökull, its neighbouring ice-cap, in 1954, found none which exceeded 4 feet (1·3 metres) in height.[15] On the western side of Vatnajökull, in 1951, one of the present authors saw several whose summits rose 10 feet (3·1 metres) above the ice surface, but the only other recorded specimens whose heights approached 15 feet (4·6 metres) were those seen on Solheimajökull near the south coast of Iceland by members of the Durham University Exploration Society's 1948 Expedition.[16]

It has been stated that the heights of dirt cones which have an ice core do not indicate the minimum amount of seasonal ablation.[17] However, since the cone described above was not more than 4·6 metres in height, whereas the surface of the glacier in its vicinity was apparently being lowered at a mean annual rate of 6·2 metres, it would seem that the dirt which covered the top of this cone could, at the beginning of the 1956 ablation season, have been situated at the bottom of a pot-hole in the ice some 1·6 metres in depth. Furthermore, since none of the other cones on the E. Glacier reached anything approaching this height, nor were any of them in an advanced state of decay, it would seem that they were not more than a few weeks old, and were most unlikely to have been in existence at the beginning of the 1956 ablation season. This agrees with Swithinbank's view that dirt cones whose heights are not greater than the amount of annual ablation are formed in a single melt-season.[18] It seems probable that only those of greater height can have been initiated in some previous season, having survived burial beneath and the melting of at least one winter's snowfall. None of the dirt cones seen on the E. Glacier in August 1956 were in this category. However, whilst many of those which Swithinbank saw on Skaftarjökull at the south-western edge of Vatnajökull in 1947 were in all stages of decline,[19] the dirt cones on the E. Glacier reached early September, which was virtually the end of the 1956 ablation season, in good shape, as did many of those in this same area which were examined by Bout in 1950.[20] Nevertheless, by that date the thickness of their dirt cover was in general not more than *c.* 3 millimetres, which would appear to be the critical limit.[21] Thus, even if they had been able to survive the melting of the succeeding winter's snowfall, which seems unlikely, they would probably have declined quickly during the following spring. In short, it would seem that the dirt cones which were seen on the surface of the E. Glacier in late August and early September 1956 were the result of ablation in that year only, and that any which were in existence during the following summer would have been members of an entirely new generation.

Acknowledgements: The authors are indebted to the Colston Research Society for financial help towards the cost of the illustrations. The vertical air photographs are published by permission of the Icelandic National Research Council.

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[3] The names of the overflow channels, shown in brackets, are those indicated on Sheet 46 of the 1:100,000 map published by the Danish Geodetic Institute, Copenhagen, 1948.

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[8] Thorarinsson, S., *op. cit.*, p. 237.

[9] Green R., "Sedimentary sequence in the Hagavatn basin," *Jökull* **2** (1952) pp. 10–16, Reykjavik.

[10] Wright, J., *op. cit.*, p. 219. (This paper includes a copy of the 1934 map on a scale of 1:40,000).

[11] An unpublished report of the "Durham University Exploration Society's 1950 expedition to Hagavatn (Iceland)," which includes an account of the survey methods and a copy of the map, was kindly made available by the Society's Student-President.

[12] Printed copies of this map have been presented to the Royal Geographical Society and the National Research Council of Iceland. Copies are also available for inspection at the offices of the British Schools Exploring Society, Vincent House, Vincent Square, London, S.W.1.

[13] The accuracy of the ice margin on the 1956 map is confidently assessed to lie within the plottable error of *c.* 6·5 metres. From a careful inspection of the 1950 Durham map and the relevant survey report, there is no reason to suppose that this map was any less accurate. However, since the 1950 ice margin was traced off the Durham map, its accuracy is not claimed to be better than *c.* 13 metres. Hence the first figure shown in column (b) is probably accurate to within *c.* 20 metres (13+6·5). The plotting of the 1945 ice margin from the air photographs is of an assessed accuracy of *c.* 30 metres, and thus the second figure shown in column (b) is probably accurate to within *c.* 43 metres (30+13). The transference of the 1934 ice margin from the Cambridge map is assessed to be within *c.* 20 metres, and hence the third figure shown in column (b) is probably accurate to within *c.* 50 metres (20+30). It follows that the last figure given in column (b) is probably accurate to within *c.* 27 metres (20+6·5).

[14] The corresponding figures for the Hagafellesjökull Vestri (W. Glacier), measured along the line GH as shown in Figure 1, are 1380 and 63 respectively.

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[18] Swithinbank, C., "The origin of dirt cones on glaciers," *J. Glaciol.*, **1**, 8, (1950) pp. 461–5.

[19] *Ibid.*, p. 463.

[20] Bout, P., *op. cit.*, p. 105.

[21] Warren Wilson, J., "The initiation of dirt cones on snow," *J. Glaciol.*, **2**, 14 (1953), pp. 281–7.

THE WATER HYACINTH: A NEW PROBLEM ON THE NILE

P. A. GAY AND L. BERRY

THE NILE is of vital importance to the inhabitants of the riverain area of the Sudan as a line of communication, a source of irrigation and drinking water and of food. Since the entry of the water hyacinth, *Eichhornia crassipes*, into the river during the last two years each of these aspects has been adversely affected and the plant's history in the tropics indicates that unless counter measures are successful the problem will rapidly become serious. This account outlines the local history of the spread of *Eichhornia* and describes some of its attendant problems. It is based on observations made by Gay in March–April 1958 and by us both in September–October 1958. We are grateful to the Hydrobiological Research Unit of the University of Khartoum for facilities provided; and to Government officials and others resident in the affected area who have provided information.

Eichhornia crassipes was not present in the Bahr el Ghazal or White Nile in December 1956, but when it was first recorded by Gay in March 1958 it occupied the 1000 kilometre stretch of the main river between Shambe and Kosti[1] (see Fig. 1). The early stages and origin of the infection are unknown, but its very rapid spread since March 1958 indicates that it could have attained this range within a year or so of first entering the Nile system. *Eichhornia* is now known to have been at Kosti in December 1957, and by August 1958 it had spread to the Jebel Aulia Dam. By October 1958 it was present in the whole river between Juba and the Dam, and from Adok to just south of Jebel Aulia it formed a sub-continuous growing fringe 3 to 10 metres wide. The whole of the Bahr ez Zeraf and the lower 70 kilometres of the Sobat were similarly affected. It was present, though stunted, in the lower Bahr el Ghazal and intermittently as far as Wang Kai. Infection had also spread to many of the khors and lagoons bordering the main rivers. Outside the Bahr el Ghazal *Eichhornia* occurred also as free-floating mats throughout the infected areas. In some reaches north of Jebelein where the current is slow these mats covered over 25 per cent. of the river surface, individual mats reaching 60 by 220 metres.

Eichhornia is spreading both up and down stream. The latter results from the natural drift of mats which are broken off from the shore by the rising river, storms and passing steamers. Much of this drifting material is later stranded on islands or as the river drops, but it is able to persist on the damp banks and give rise to further infection during the next flood season. In the slower currents of the northern reaches wind has also been an important factor in determining the pattern of spread. Upstream spread is the responsibility of man. Nile steamers, with barges lashed on either side and to the fore, carry entangled plants considerable distances into formerly unaffected stretches. On the Sobat the plant is so far restricted to the reach frequented by clay barges.

Nile steamers are not manoeuvrable enough to avoid the masses of floating vegetation and services have been delayed by as much as a day on the Kosti-Juba run because of the frequent stops necessary to clear water intakes and paddles. Local communication in Upper Nile Province is mainly by native canoes which can skim through the marginal swamp grasses with ease but which now find *Eichhornia* a more substantial obstacle which also blocks their canoe lanes. All grades of river transport are thus affected by the plant. Agricultural schemes which depend upon pump irrigation from the Nile are in operation between Jebel Aulia and Jebelein. Much trouble has been caused this year through the fouling of the pumps by *Eichhornia*, and although filters

[1] Gay, P. A. "*Eichornia crassipes* in the Nile of the Sudan." *Nature*, **182**, 538 (1958).

are employed mats quickly accumulate in sufficient quantity to make clearing difficult. South of the limit of the pump schemes the Shilluk tribe occupies the Nile banks as far as the north of the sudd region. The Shilluk are among the keenest fishermen of the Upper Nile, the majority operating from the bank with spear and net. Whereas in the past the men of the village could walk the banks of the Nile and the tributary khors to fish, the almost continuous *Eichhornia* fringe now keeps the fish offshore for extensive distances along the bank.

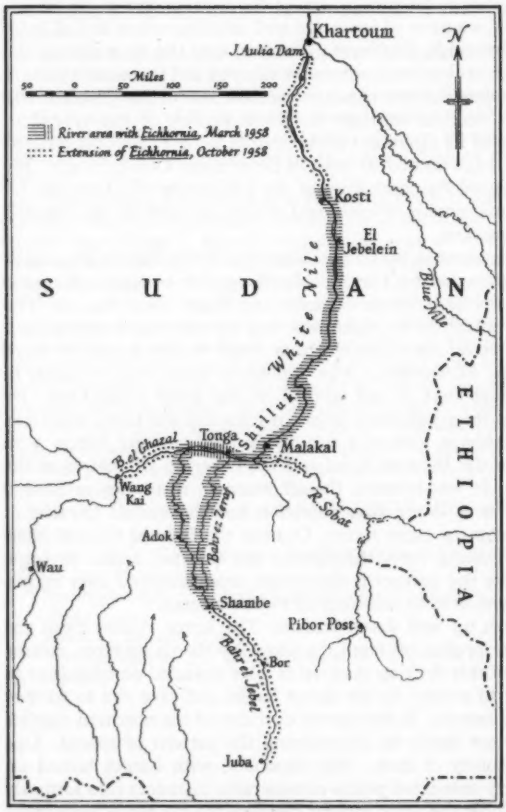


Figure 1

These present nuisances indicate the character of the problems which will arise as spread and development continue. At the moment there appears to be only a slight, but nevertheless real, danger of blockage of the White Nile, Bahr el Gebel and Bahr ez Zeraf. Fortunately, the lower Bahr el Ghazal appears to present a less suitable environment for the plant, but in the middle reach of this tributary, with its faster current and different character, the problem may become more serious. On the Sobat and Pibor the main danger of infection is from the Province steamers which take supplies to Pibor Post in the flood season. If *Eichhornia* does become established far up these rivers, blockage may rapidly follow and effectively isolate a remote part of the country which even now can be reached only with difficulty. The irrigation canals of the White Nile agricultural schemes provide a suitable environment for *Eichhornia* and infection of this niche could easily result from fragments brought in with the irrigation water and rapidly inflate the already high weeding bill. If the plant became established in competition with crops on the irrigated land a new set of problems would be created. In the Shilluk country the river consists of one main channel and several partly abandoned channels and lagoons which display various stages in the build-up of point bar deposits and their incorporation into the main flood plain. The flood plain is the seasonally inundated "toich" land which provides winter grazing for the cattle. Village settlements are found on the edges of the main valley on dry ground and part of the life of the Shilluk is intimately bound up with the fishing and grazing

conditions in the Nile valley.[1] The lagoons and side channels already are infected with *Eichhornia* and proliferation here could have rapid consequences affecting the life and customs of these people. The spread of the plant on to the "toich" lands would create additional difficulties in control.

Other problems relate to the probable spread to other parts of the river system. The Jebel Aulia Dam is not a fully effective barrier as plants are washed through the fish ladder, pass through the lock gate with steamers and are thrown over the face in violent storms. The way is thus open for spread to continue down the river although *Eichhornia* has been present in the Egyptian Delta region for about sixty-five years.[2] Spread into the Blue Nile system can be prevented with care as there is little river traffic and the current is comparatively rapid. However, fishermen are already carrying the plant from the Dam into Khartoum in order to protect their catch from the sun, and it is impossible to predict where this may lead. The Sudan has the advantage of extensive research carried out in the Belgian Congo where some control of the plant has been attained. There, hormone spraying has proved to be the most effective control measure and this has been linked with strict inspection to prevent further spread. The physical background of the Nile differs significantly from that of the Congo so that problems will differ particularly in the effect of *Eichhornia* on inundated "toich" land and on pump-scheme economics, both of which will become more marked with time. Control of *Eichhornia* is a problem affecting the whole Nile valley and, as with other Nile problems, can only be resolved on an international basis.

[1] Jonglei Investigation Team. 'The Equatorial Nile Project and its effects on the Anglo-Egyptian Sudan.' Sudan Government, 1954.

[2] Täckholm, V., and M. Drar. 'Flora of Egypt,' Vol. 2. Cairo, 1950.

FROM THE *JOURNAL* A HUNDRED YEARS AGO

THE FOLLOWING extract is taken from the obituary section of Sir Roderick Murchison's presidential address, delivered at the Anniversary Meeting of 23 May 1859, and published in the *Journal of the R.G.S.*, Vol. 29, pp. cii and cvii–cviii.

"In mourning for the loss of the most illustrious geographer and traveller of our age, I naturally open the Address to this Society by laying before you a brief sketch of the career of Baron Alexander von Humboldt, and by an effort, inadequate as it must be, to pay a due tribute to the memory of him who, in the course of a long, well-spent, and glorious life, has justly obtained the admiration of mankind. . . .

"That Humboldt lived unto his ninetieth year is chronicled; but knowing well his habits, I may be permitted to say that in reality he lived upwards of a century: for, whilst the average daily amount of sleep of man is seven or eight hours, the rest he took from his earliest youth never exceeded four hours; all his waking moments being so vigorously and profitably employed as virtually to constitute a century of highly-strung mental existence.

"Though he was a good listener, and a clear questioner whenever he sought to obtain knowledge from others (which, by the bye, he never forgot), it may be also said of him that in his long career he talked more than any one of his contemporaries with whom I have been acquainted. His correspondence was particularly extensive, and the piles of letters which he had to answer almost overpowered him. And yet a few months before his death he not only took the trouble of replying to many of his old scientific correspondents, but I have before me a copy of a long and kind letter which he wrote last year to our worthy associate Mr. John Brown, with whom he was personally unacquainted, thanking him for the present of his volume on 'Arctic Discoveries.'

"Nor is it to be forgotten that he took particular delight in conversing with women, and that he was a great favourite with them; his soft voice and persuasive diction, in which he conveyed instruction without hard words or ostentation, being peculiarly grateful to the gentler sex, to say nothing of that *piquant* irony in which he frequently indulged.

"But it was not merely by his courtesy and correspondence that Humboldt won the affectionate attachment of mankind. He was invariably the ardent and disinterested promoter of merit and desert, under whatever form they were presented to him. Every young man struggling with difficulties, who had shown signs of energy in the cause of science, was sure to find in him a zealous and generous protector. Thus, as it was the constant practice of his life to spare no trouble in sustaining those who had need of support, his loss will be deeply felt by men of science, art and letters, not only in Germany, but throughout the civilized world."

Drifting Eichhornia in Jebel Aulia basin, 20 September 1958

Heavy drift of Eichhornia, papyrus and grasses near Gebelein, September 1958

Thick new marginal fringe of Eichhornia near Gebelein, September 1958, normal grass swamps in background

TRANS-ANTARCTIC JOURNEY

THE CROSSING OF ANTARCTICA. By Sir Vivian Fuchs and Sir Edmund Hillary. *London: Cassell, 1958. 9 × 5¾ inches; 338 pages; colour and monochrome illustrations, maps.* 30*s*

This is the official story of the Commonwealth Trans-Antarctic Expedition, 1955–8. It is an absorbing, straightforward narrative of a highly successful expedition, written by the leader and with certain chapters provided by Hillary and other members of Fuchs's redoubtable team. The illustrations are exceptionally fine, but the nine small maps do not include all the geographical names mentioned in the text, are inadequate for easy reference and fail to do justice to the story. There was clearly insufficient time to draw special maps after the text had been written, due to the usual necessity these days for speedy publication. This weakness should be rectified in later editions and certain diagrams provided.

Her Majesty The Queen graciously consented to be Patron of the expedition. Four Commonwealth Governments contributed over one-third of its cost and the New Zealand Government assumed responsibility for the Ross Sea Party and Scott Base. Generous support was given by Government departments, the Services, Trusts and Societies (including, and first of all, the R.G.S.), nearly four thousand schools, and by hundreds of industrial firms. The expedition might well have foundered in late 1955, when the *Theron* carrying the reconnaissance and advance parties entered the Weddell Sea not far enough to the east and became jammed in the ice. This delay forced the ship to leave Shackleton, the site for the new base, as soon as unloading had been completed. Later, severe gales swept away part of the ice shelf, together with considerable quantities of expedition stores, and prevented the eight members of the Advance Party from finishing the building of the base hut. For six months the men slept in tents and lived otherwise in a Sno-Cat packing case, measuring 21 by 9 by 8 feet. Undaunted by these catastrophes, the party completed the hut in the teeth of winter; their endurance and determination are beyond praise.

The main party in the *Magga Dan* arrived at Shackleton Base on 13 January 1957—two-and-a-half vital weeks earlier than the *Theron* in the previous year. The following month the R.A.F. team, equipped with an Otter and an Auster aircraft, established South Ice, a scientific station 300 miles inland. Meanwhile, on the other side of the continent, Hillary's party was erecting Scott Base, which consisted of six main huts on Ross Island; their programme was going very well indeed. A dog-sledge party under Brooke ascended the Skelton Glacier and reached a height of over 8000 feet on the polar plateau. Here the two single-engined aircraft, a Beaver and an Auster, were "successful in completing the stocking of the Plateau Depot" after laying a nearer depot at the foot of the same glacier. The stage was thus set for additional support depots to be laid by Hillary, and for Fuchs's team to make the first crossing of the continent. Winter now intervened.

Hillary's Ross Sea programme for the 1957/58 spring and summer season included a Southern Party with four dog-teams, three Ferguson tractors and one Weasel, and a Northern Party with two dog-teams; each party was to be supported by the two aircraft. Brooke's Northern Party was away from base for 126 days and sledged over 1000 miles; twenty-nine mountain-top survey stations were set up and sixteen camp survey stations. The area between the Mawson Glacier to the north and the Skelton Glacier to the south was covered, Mount Huggins (12,870 feet) climbed and much geology done.

The plan for the Southern Party was more complex, since it was not known whether the Ferguson tractors would function efficiently at the high altitude of the polar

plateau. If they were not able to establish the two further Depots 480 and 700 (500 miles from the South Pole), then this vital task was to be undertaken by the dog-sledge element, which in any event would act as trail-breaker. On the other hand, if all went well, Hillary already had the intention of accumulating extra fuel at Depot 700 and continuing his journey to the South Pole. It seems that this alteration to the original plan was not then known to Fuchs. In fact, the performance of the Southern Party exceeded expectations as they reached the Plateau Depot as early as October 31; here they remained for twelve days while the depot was stocked with further supplies for Hillary, presumably to help his party reach the South Pole. On continuing the journey, snow conditions became so soft at one stage that the Weasel had to pull as much as five tons whereas, due to poorer traction and the high altitude, the three Fergusons, roped together, could pull only six tons. Near lat. 80° S. the site for Depot 480 was reached; here half the dog-team element split off to carry out survey around Darwin Glacier, the other half continued to break trail further south and the tractor party stayed until December 6 to receive air supplies. Eventually, on December 15, the Southern Party reached Depot 700 which, like the previous depots, was duly stocked by the highly efficient air contingent. It was now that Hillary finally decided to continue to the South Pole; this he reached on January 4, after jettisoning everything "he could possibly spare" and "even spare sledges." Three days later Hillary and his four men were flown out by the Americans to Scott Base.

While full of admiration for this great journey, I doubt the wisdom of the support party proceeding the whole way to the Pole. Either Hillary over-emphasized the difficulties for Fuchs's party and realized that the quickest way for his own tractor team to get back to Scott Base was to be flown out from the Pole, or there was an error of judgement; this can easily occur under severe polar conditions, particularly if a party fails to eat a properly balanced polar ration. I mention this as a possibility, as Hillary "completely modified" the polar ration successfully used by Fuchs's party and I am always sceptical when this takes place in the field; a polar ration is very different from a mountaineering one.

The New Zealand survey party with two dog-teams left the tractor party at Depot 700 on December 20, in order to map the mountains west (not east) of the Beardmore Glacier. They were carrying out an excellent programme when they received instructions to return to Depot 700, which they reached on January 15, to receive additional air supplies at the depot for Fuchs's party. If Hillary had supported the survey and not used up precious fuel supplies by his journey to the Pole, the survey east of Depot 700 could have been greatly extended. Miller and Marsh performed a fine feat of endurance; they travelled 1670 miles and their journey lasted from October 19 to February 22. Under less arduous conditions but with no form of support, I have myself taken part in a survey journey by dog-sledge of 1250 miles and can begin to assess the quality of their performance. Miller's journey emphasizes what can be done in the polar regions by combining good dog-sledge technique with air support.

Meanwhile, in the Weddell Sea sector, Fuchs's reconnaissance party had taken thirty-seven days and 400 miles to reach South Ice, the advance base for the trans-Antarctic crossing. Two dog-teams were already there before his arrival on November 13 with one Sno-Cat and a Weasel: he and his party had had an incredibly difficult journey through heavily crevassed, mountainous terrain. Two days later they flew back to Shackleton in two-and-a-half hours to prepare finally for the main journey.

Fuchs's party set out for the last time from Shackleton on November 24 with three additional Sno-Cats, two more Weasels and a Muskeg tractor. After overcoming every sort of hazard, the party reached the South Pole on January 19. All members of the American base gave them a great welcome; Admiral Dufek, in charge of United States operations in Antarctica, together with Hillary, had flown there to greet them with various reporters, and returned that night to McMurdo Sound. The reporters had expected Fuchs to discuss his "decision" as to whether or not he intended to con-

tinue his journey. There was, however, no decision to be made; Fuchs had made it already.

When Fuchs's party had finally left South Ice, the R.A.F. contingent prepared for the first flight over the South Pole of a single-engined aircraft; if successful, the Otter aircraft would join the Beaver at Scott Base and provide additional air support for the later stages of Fuchs's journey. Lewis's air-crew fitted an auxiliary tank in the fuselage, thereby doubling the Otter's endurance. The 356 gallons of fuel gave a flying range, in still air, of 1600 miles, whereas the distance to be flown was 1400 miles; there would be little margin for navigational errors. The plane took off from South Ice on December 27, but after some hours the weather deteriorated and ice began to form on the leading edges of the wings. Reluctantly Lewis decided to return to South Ice. Thick cumulous clouds now began to cover the polar plateau but, by good fortune, the crew saw vehicle tracks through a patch of cloud; descending to only ten feet from the surface, they followed the tracks to their destination. This performance was far more exacting and remarkable than the actual trans-Antarctic flight which was successfully completed on January 6.

The rest of the story is relatively well known. On January 24, Fuchs's party left the South Pole for Scott Base, some 1250 miles ahead; behind them lay Shackleton, only 900 miles away, but far the most treacherous and difficult part of the journey had been overcome. At Depot 700 Hillary arrived by air from Scott Base and his local knowledge of the remainder of the route proved invaluable. At Depot 480 they found all the fuel, lubricating oil, gear oil, grease and food which they required; thenceforward they conscientiously took with them, or had flown out, any stores which they could not use, rather than leave them to be lost in the field. Eventually, on March 2, they arrived at Scott Base and the 2158 mile journey was over. Fuchs had estimated the journey would take 100 days at an average speed of about twenty miles per day. The crossing actually took ninety-nine days.

A number of us have taken part in an even longer journey with over-snow vehicles, but no such journey has been carried out over such difficult crevassed terrain and under conditions comparable with those so successfully overcome by this expedition. The crossing was undertaken by a fine team of men, ably supported by the Ross Sea Party and the air-crews. Fuchs's confidence in his Sno-Cats and other vehicles was fully justified; a payload of one ton was carried in each vehicle and, by using runner material with a low coefficient of friction on their towed sledges, each Sno-Cat hauled two sledges, loaded with 2½ tons on each.

Of all the achievements during this International Geophysical Year, this expedition has particularly captured the imagination of the world. The results of the comprehensive scientific programme carried out by both main bases and most of the field parties are eagerly awaited.

ANDREW CROFT

AN OUTSTANDING NATIONAL ATLAS

NATIONAL ATLAS OF INDIA: Preliminary Hindi Edition. Edited by S. P. CHATTERJEE, Director of the National Atlas Organization, Ministry of Education and Scientific Research. *Dehra Dun*, 1957. *Rs* 125

THE PUBLICATION of the great National Atlas of India is an event unique in several ways. In many countries it has been urged that a National Atlas is an essential part of the stock-taking of resources so vital in an expanding or changing economy. In the ten years since Partition in 1947 India has faced many problems and is doing so through a succession of Five-Year Plans. Very wisely, the preparation of a National Atlas was made part of the Second Five-Year Plan. The project had indeed been discussed for some years; action came when Professor S. P. Chatterjee, head of the department of geography in the University of Calcutta, was entrusted with the task under conditions at once ideal but onerous. He was given twelve months in which to start and finish the work: the limiting factor was not the usual one of money but the availability of trained personnel. Amid the classical columns of the old Assembly Hall of the University of Calcutta the National Atlas team worked as a group inspired by the urgency and enormity of their task: the full resources of the Survey of India offices at Dehra Dun were directed towards speedy printing and production. As a result the task was completed to schedule; the printed sheets were avilable for their loose-leaf binding by December 1957.

The format adopted is almost the maximum possible for an atlas. Each sheet measures 30 × 26 inches (26 × 15 inches when folded) which allows a standard scale for the main maps of 1 : 5,000,000. It is the declared intention of the Indian Government to switch entirely to the metric system. The coinage has already been decimalized with rupees of 100 *naya paisa*; the Atlas anticipates the other changes by using metres for contours and heights, kilometres for distances, millimetres and degrees centigrade on the climatic maps, hectares, metric tons and kilograms in the production maps. In itself the conversion must have involved no mean task. We must now get used to 8848 metres as the height of Everest and such statistics as a railway network of 55,923 kilometres. In general it may be noted that most figures refer to 1956, population to the 1951 Census.

The efforts to make Hindi the national language of India are well known and so the maps are entirely in Hindi. But one of the loose leaves provides an outline map with all place names in English and on the back is a complete translation of every map-key into English so that each may be cut out and, if desired, pasted on the appropriate map. The long descriptive text is in both Hindi and English—indeed, the standard version is the English, some Hindi words and spellings are provisional. In this clever way national aspirations have been blended with international usefulness.

Turning to the maps themselves, there are twenty-six sheets, nearly all in full colour and most with several inset maps. On some maps as many as 35 tints are used and every map has some original feature. The first plate showing India's world relationships, for example, does so with India centrally placed and the locations of the various representatives abroad shown in relative position. The invaluable administrative map numbers over 3000 *tahsils*, *talukas* or *thanas* so that one can readily identify each from the lists in English and they are arranged according to the states as redefined on 1 November 1956. The physical maps, Plates 3, 4 and 5, show both relief according to layer-colouring and relief features. River basins are demarcated and perennial streams are differentiated from non-perennial whilst an inset map shows areas liable to flooding. In all cases the background map is printed in grey, but not quite strongly enough to show through effectively. The climatic maps being newly drawn from the records of some 3000 stations serve to correct those previously

available. The geological maps break away from the conventional by including geolithology and the deformation of the geoid; the map of forests shows dominant trees; the maps of cash crops relate them to associated industries; the map of milch cattle connects them with population density and that of working cattle with arable area. The railway map deals also with volume of passenger traffic and accessibility; the airways map classifies airports according to numbers of passengers handled. The education map is coloured according to literacy and shows also the seats of higher education. The final map covers sites of archaeological interest and tourist attractions and rounds off a whole which has missed few of the essentials. Indeed, this atlas deserves to be studied not only for its intrinsic interest but as an example of methods and technique in cartographical representation of data. Yet it is described as only a preliminary edition. Professor Chatterjee has long been a staunch advocate of a detailed land use survey of India as an essential basis for national planning. He has prepared in MS. several experimental sheets on large scales which demonstrate at once the complexity of the pattern and the intimate relationship with such factors as soil, sub-surface drainage and micro-climate. In editing the national atlas he has afforded a clear overall picture which does not in any way supersede the need for detailed work. Work is already in hand on a larger atlas which will involve over 300 plates and which will probably extend into the period of the Third Five-Year Plan.

To keep the present atlas at the lowest possible price it is obtainable only direct from the Director of the Survey of India at Dehra Dun. There is a "Popular Edition" (the difference is not clear) available at 100 rupees whilst individual sheets of maps are obtainable at Rs 5 each (7*s* 6d) or Rs 3.50 for the popular edition.

L. DUDLEY STAMP

AFRICAN OPPORTUNITY

SCIENCE IN THE DEVELOPMENT OF AFRICA. By E. B. WORTHINGTON. *Printed in Great Britain by Stephen Austin and Sons Ltd.*, 1958. $9\frac{3}{4} \times 6\frac{1}{4}$ *inches;* xix + 462 *pages; maps and plates.* 30*s*

THIS WORK HAS been prepared at the request jointly of the Commission for Technical Cooperation in Africa South of the Sahara (C.C.T.A.) and the Scientific Council for Africa South of the Sahara (C.S.A.); and they are, as it were, its publishers too. Dr. Worthington was Secretary-General of the Scientific Council and for that reason was the proper author for this compendium. Yet far more than that reason alone has made him the master of scientific survey for the African scene. Twenty years ago his 'Science in Africa' emerged as the companion volume to Lord Hailey's 'African Survey,' and now this present volume appears contemporaneously with 'African Survey revised.'

It is a fascinating study in itself to observe the evolution through two decades of progress in African scientific and technical cooperation, of political change and new institutions, of the mellowing wisdom of Dr. Worthington himself, and of the transition from the old volume to the new. Dr. Worthington is a master of compilation; but he does not, fortunately, leave the matter there but proceeds to digest, distil, and expound. One cannot but admire, greatly and with gratitude, the power, the patience and the perspective which he possesses in abundance.

'Science in the development of Africa' has about a quarter of a million words, which is fifty thousand less than its predecessor. Part of the reduction derives from the omission of certain appendices, and part from condensation. There is a pleasant change from the old need to describe area by area to the broad perspectives now more suitable as intercommunication, integration and interdependence grow. Interests become less distinctly territorial in all fields, even in the political. The general plan of the new volume, and the chapter headings, resemble those of twenty-five years ago. But now we are treated to a masterly additional section on "Principles and generalities," before proceeding to the main groups of chapters now labelled "The physical background," "Biological subjects" and "Human subjects." The new volume is as definitely different from the old as is an experienced man from an able youth. The ancestry is clear but each section has evolved in connection with new knowledge, new needs and still wider perspectives. The characteristic phrase and the helpful idea or comparison are still discernible, but the whole is new, rounded, and most welcome. Whereas 'Science in Africa' was primarily a well-written reference work, 'Science in the development of Africa' is much more. The writing and the arrangement are such that one enjoys the process of reading. Having sought and found an answer to a particular point many will undoubtedly be enticed, like bullfinches among the fat fruit buds, to wander and to pluck at leisure and to personal advantage.

'Science in the development of Africa' must make one ponder many things. Dr. Worthington explains much and stimulates much. The Africa which he describes has suffered many vicissitudes—slave-raiding, disease, chaos, soil erosion, the loss of much of its mammalian fauna—but today there is in general a benevolence on the part of advanced peoples towards those that are still primitive. That last word is admittedly out of fashion, however truthful in fact it is: under-privileged or some other euphemism is now the vogue. Yet, in the long context of history, conscious benevolence of one group towards another, the taxation of citizens for the good of others, is not general and, whatever one's personal hopes, it will not necessarily remain so. Fast multiplication of populations almost everywhere may not be a favourable circumstance for continued benevolence. On the other hand, the cynics will always say that an appearance of benevolence will last just so long as it seems to pay. Be that as it may, let Africans make use of the present favourable

circumstances for their advance, however patchily opportunity may be spread over the continent and however diverse, precarious or emergent, the local political regime. China, India, Central America, Europe, the valleys of the Nile and the Euphrates, have all flowered at one time or another in the last few thousand years—and remember that a thousand years is but thirty generations of our own slow-maturing species. "Africa . . . as far as we know, has never produced civilizations of its own. . . ." Advance for Africa south of the Sahara may be regarded as still in embryo. Whether the embryo will, or will fail to, prosper depends fundamentally upon the inborn attributes of Africans, however friendly the helping hands held out to them today. Opportunity is at the gates, but whether she will be welcomed in, and allowed by Africans to burgeon, is for our grandchildren to observe. Dr. Worthington describes the scene today rather than attempts to prophecy the outcome: he is no seer nor crystal gazer.

The index to 'Science in Africa' had an entry "Indian immigrants," but the present volume does not, so that the author's assessment of the influence of those people from across the ocean is not easily traceable. Nor does he estimate the repercussions of political change upon the rate of future development and the probable well-being of peoples. Such considerations, important as they are, were properly beyond the scope of the assessor for an international body. Yet it may be indicative in this connection that Liberia appears in the index only in connection with a couple of references to rubber and the Firestone Company.

Throughout his writing Dr. Worthington notably stresses that the problems are fundamentally human ones, problems based on human numbers, human traditions, human needs and human actions. The background complex of population and resources he clearly recognises. But some may feel that he skims over it with too prudent a wisdom. He could perhaps have stressed more boldly the problems which accompany the over-speedy, induced passage, from the primitiveness of original high birth and death rates to those stages of great population growth during which death rates (as is world experience) fall so much faster than birth rates. Yet he makes the sage remark ". . . it would be a service to Africa to concentrate most of the effort during the early years on ensuring a truly prosperous economy by the development of natural resources and the encouragement of productivity to the maximum, even if some of the social services had to be delayed meantime."

In a survey of this nature, and with so comprehensive a bibliography, it might have been helpful to include the opportunity for a wider world perspective by reference, for example, to that compendious 'World population and resources' published by Political and Economic Planning in 1955. Africa south of the Sahara contains about 125 million people and provides the earth's largest remaining block of primitive humanity. It is difficult indeed, mentally, to keep pace with the modern boundings of world population. Two thousand seven hundred millions is now surpassed so that the "Worthington area" is the home of under 5 per cent. of human kind. The world total increases by 47 millions annually and that figure itself still increases. Thus the total population of Africa south of the Sahara contains the equivalent of the world's net increase in about a thousand days. The positive advantages of such population increases have yet to be demonstrated, while the disadvantages are numerous enough and all too sad in contemplation. A particular aspect is the almost universal and seemingly inevitable decrease of personal freedom as agriculture becomes institutionalized, and managed from above in accordance with the needs for higher yields, and life becomes more urbanized and industrialized. Where lies the optimum for personal happiness, well being and freedom for the generality of humble men and women has not been estimated. Dr. Worthington does not express himself in just these terms, but perusal of his work will convince the reader that he recognizes a worthy human goal with "science" as the servant in the development of Africa. He has produced a book which is truly outstanding and for which he should receive the gratitude of many far beyond the continent of Africa.

G. C. L. BERTRAM

REVIEWS

EUROPE

BRITISH IRON AND STEEL INDUSTRY. By H. R. SCHUBERT. *London: Routledge and Kegan Paul*, 1958. 10×6½ *inches;* xxi+445 *pages; sketch-maps, diagrams, plates.* 60*s*

This is a very important, as well as a very attractively produced, volume, bringing together for the first time the results of much scholarly investigation. It may seem an odd commentary on our research programmes that a German refugee should be called upon to fill this notable gap in our industrial history, but this has had the valuable effect of adding perspective, by linking British developments to those in Western Europe with which the author is equally familiar. With the resources of the Iron and Steel Institute behind him, he deals mainly with the technological side of the industry. This is very well done, a broad distinction being made between the "direct" and "indirect" processes of manufacture, hinging on the introduction of the blast furnace in the 1490's. Chapters are devoted to iron manufacture in prehistoric, Roman, Saxon and Norman times, followed by a fuller treatment of the vicissitudes of the industry during the Middle Ages. An important, and seemingly well authenticated, point is made when attributing much of the wholesale destruction of timber during the "golden age" of English agriculture (1250–1350) to the demands of iron working, but there is clearly need for further investigation here.

There is an attempt at regional treatment, but some of the maps are faulty, notably on p. 79, where Derby is confused with Stafford, and on p. 180 where "Beandesert" should be "Beaudesert" and "Litterstone" should be "Titterstone". And although two chapters are devoted to steel manufacture there is no mention of blade mills which became an indispensable concomitant of cutlery and edge-tool making in Sheffield and Birmingham after 1500.

But it is in its treatment of the eighteenth century that the book is really disappointing. Perhaps out of deference to the well-known studies of Professor Ashton the author devotes only five pages to the "Transition from charcoal to coke," whilst the interesting and well documented struggle of English ironmasters to maintain charcoal iron working in the face of increasing overseas competition is dismissed in a sentence. Furthermore, through his unfortunate assumption that James Watt *invented* the steam engine (p. ix) which "passed from the experimental to the commercial stage in 1775" (the terminal date of the study) the author overlooks the hundreds of Newcomen and other engines made before that date which were significant products of iron manufacture. But in spite of these blemishes this study will for long remain a standard work. Students of both history and geography will be grateful to Dr. Schubert for making available such a wealth of original material both in the body of the book and in its particularly valuable appendices.

R. A. PELHAM

THE BLACK FENS. By A. K. ASTBURY. *Cambridge: The Golden Head Press*, 1958. 9×5¾ *inches;* 217 *pages; plates, maps.* 42*s*

It must be emphasized that this is not a new authoritative work on either the physical or human history of the peat Fens, but a book aimed primarily at the layman interested in the area. It falls really into two parts. The first sixteen chapters are concerned briefly with topics such as "Farming and soil erosion," "Problems of building on the peat," and "Railways on a vegetable soil." They are mainly self-contained and provide interesting information to anyone curious about the landscape, though the quality varies, the parts on the physical formation of the Fens not being particularly successful in expressing specialized information in a generalized but clear and accurate manner

for the general reader. The remaining seven chapters, almost half of the book, consist mainly of speculations about the identity of the builders of many of the artificial waterways of the Fens. This appears to be the author's main interest and this part of the book is considerably more detailed than the first part. The author admits his great indebtedness to Gordon Fowler for much of the material of this section, but it is discussed in a critical fashion and theories are put forward with care and modesty.

The book is well illustrated with plates, but more maps would have assisted the comprehension of some of the detective work, and references would have helped those whose interest was stimulated by this book. The chapters might have been arranged differently with all the material on waterways being placed consecutively, and one feels a certain repetitiveness on reading the book straight through, which would not be apparent if separate chapters were being read. Some splendid statements of the obvious, *e.g.* "I doubt whether dust storms can be stopped except by weakening the wind or strengthening the soil" (p. 61), are mixed with nice pictures, such as that of broken pots being thrown into waterways by "Romano-British householders, picnickers or drunks" (p. 139), and with a list of lake names (p. 108) which includes such "Toddayesque" gems as Harts Booze and Gasp Water. B. W. SPARKS

THE LAND OF THE THREE RIVERS. By HELEN G. BOWLING, L. C. COOMBES, and ROBERT WALKER. *London: Macmillan*, 1958. 8×5 *inches;* 308 *pages; maps, plates and line-drawings.* 12*s* 6*d*

This is a book about Northumberland, County Durham, and part of North Yorkshire, and is designed mainly for school children who live there. It is not intended as a geography book. Indeed, the viewpoint from which it is written is fundamentally historical, and the arrangement of the material is primarily chronological rather than systematic. Although a reader intent on one particular theme may find this inconvenient, it is an arrangement which works well on the whole. The authors recognize that the size and scope of the book must involve some omissions. It is true, for example, that most "geographical" readers would probably like to see more space devoted to an explanatory description of the physique of the area; for the general topography and its geological basis are largely confined to eight pages in the introductory chapter, while climate as such claims no space at all. It is also a pity that there is no large general map.

Such criticisms, however, are small compared with the success of the book as a whole. Although historical in intention, it is geographically valuable because it can hardly fail to enhance the reader's understanding of the area; and it can therefore be read profitably by a public wider than the rather restricted one for which it has specifically been written. The book is well produced and, generally, well illustrated. A few minor slips in the text and figures are of little consequence and will no doubt be rectified in later printings. J. I. SHARP

BRITISH PORTS AND SHIPPING. By HENRY REES. *London: Harrap*, 1958. 8×5½ *inches;* 304 *pages; maps, diagrams, plates.* 18*s*

The dedication of this book is "To the memory of Professor Ll. Rodwell Jones who encouraged me to think about these things." Throughout the book the author proves himself a true disciple of Rodwell Jones in that he also encourages thinking. The subject is so vast that no book of this size, 304 pages, could deal with all aspects of even a few of our ports, yet by skilful selection of material all the major ports and many smaller ones are described. Each port is introduced by a short history of its growth, especially where concerned with the layout and expansion of the docks and the capacity and equipment provided. Specialist developments are emphasized by the happy method of noting the traffic, giving the name, port of origin, tonnage and cargo of all ships using the port over a given time. This makes interesting and informative reading and demonstrates the versatility of some ports and the specializations of others. It

exposes unexpected links as, for example, the seasonal traffic in small coastal steamers of seed oats from Aberdeen to Bideford, 1000 miles without a break, and emphasizes the development of such industries as that, for example, of cod liver oil in the Humber ports where a half of the world's supply is prepared. This book is useful and informative for all interested in ships and shipping as well as in economic geography. A. C. O'DELL

BRITISH WEATHER IN MAPS. By JAMES A. TAYLOR and R. A. YATES. *London: Macmillan*, 1958. $8\frac{1}{2} \times 5\frac{1}{2}$ *inches; 256 pages; maps and diagrams.* 21*s*

The geographer's interest in meteorology is largely concerned with the knowledge, understanding and appreciation of weather phenomena as an essential corrective to the generalizations of normal climatic descriptions. The raw material for such a corrective is provided by synoptic weather maps, and during the past decade many geographers have commended their analysis as a means of both teaching and studying weather conditions. It is only with this book, however, that the many diverse meteorological situations which produce Britain's weather have been systematically presented, with their characteristic weather phenomena described and, in general terms, explained. With weather maps, air mass trajectories and upper air diagrams, plus eight to twelve distribution maps of the significant weather elements of each weather map, this book gives a clear and concise picture of a variety of meteorological situations and of the weather differences between them. In this way the authors have provided a useful addition to the geography student's library, and a helpful guide to the sixth-form geography teacher.

It is in explaining these weather conditions that this book is weakest, and although the authors disclaim any intention of making this a meteorological textbook, nevertheless several points need rectification. These include such a misleading statement as that it is "the 'low' over the continent of Europe which draws the main airflow eastwards from the Azores 'high'" (p. 2). Also, closer integration is occasionally needed between text and diagrams, especially to eliminate such discrepancies as that between pp. 11–12 and Figure 9 concerning the value of the saturated adiabatic lapse rate. A consistent order within the sets of distribution maps would also have been preferable, while the air mass trajectories would have been better traced from Liverpool, for which the upper air diagrams are shown, than from some arbitrary coastal point; this would have been particularly advisable in Figure 37. Nevertheless, this book should prove of very considerable interest and value to all who wish to understand the weather conditions associated with particular synoptic situations without the difficulties inherent in a full-scale meteorological explanation. S. GREGORY

SUNKEN CITIES. By F. J. NORTH. *Cardiff: University of Wales Press*, 1958. $8\frac{1}{2} \times 5\frac{1}{2}$ *inches; 256 pages; maps, plates, diagrams.* 18*s*

In Celtic lands there are many legends or folk-tales concerned with the flooding of lakes or rivers, or with the submergence of coastal areas. The details vary somewhat from place to place, but the destruction of towns and palaces, the escape of one or two fortunate people, and the laying of the blame on some one who, in his cups, was responsible for not attending to floodgates or sluices are common elements.

It is as easy to dismiss such tales as nonsense as it is to exaggerate their importance, and to believe in extensive areas now below sea level that were once prosperous and inhabitated by a considerable population. Many writers who have taken the more credulous point of view have linked up the tales with natural features, and some have given actual dates to the inundations.

Two of the best known stories are those of Llys Helig and Cantre'r Gwaelod. Llys Helig is, in fact, a heap of boulders, the remains of a moraine, a mile or more off Penmaenmawr. Yet some writers who have visited the site in a boat and have looked down on those stones have, in imagination, re-erected halls and palaces, and others have reconstructed roads between Anglesey and North Wales in places now well away

from the coast. Dr. North carefully and eruditely analyses all the evidence and shows that the story of the inundation is only about a century old, and is thought by some to be based on the authority of "An ancient survey of Pen MaenMawr" by Sir John Gwynn, who refers to a "manuscript" of Sir John Wynn. The authenticity of this survey was taken for granted, but Dr. North shows that it derives only from the copy of a copy and was not even intended as a survey of Penmaenmawr. All the matter relating to Llys Helig as the remains of a palace is pure nonsense.

The lost land of Cantre'r Gwaelod is supposed to be under parts of Cardigan Bay. The Sarns (Causeways), of which Sarn Badrig (St. Patrick's Causeway), is the longest are lines of boulders roughly continuing the watersheds between the rivers flowing to the bay. These also have been, at least in part, interpreted by imaginative writers as the work of man, and linked up with the lost "Hundred." A precise date, A.D. 520, has even been given to the catastrophe. Here again there is not the slightest truth in the tale as it is usually presented.

But it is very wrong to dismiss these and similar folk-tales as meaningless. Dr. North has written a most interesting analysis of the problem and shows, as had indeed been realized previously, that in those tales we may well have accounts handed down from Bronze or even Iron Age times. There is no doubt that then there was submergence of coastal areas, and there is no reason why those peoples should not have witnessed it. Dr. North's book discusses not only the folk-lore and archaeology behind the tales, but also the geological and physiographical meaning of them. He has written a thoroughly interesting, informative and reliable book that should find its way into many hands. Those who are especially interested in the coast will receive it with enthusiasm. J. A. STEERS

THE MOREA. By ROBERT LIDDELL. *London: Jonathan Cape,* 1958. $8\frac{1}{2} \times 5\frac{1}{2}$ *inches; 255 pages; map and plates. 25s*

There is still a large public for the travel-writer in this shrinking world, but his scope is sadly reduced. If he cannot seize upon one of the few remaining virginal territories he is apt to work over the known ground in some specialist's dimension, or else to use it as the background for a tour of his own personality; in neither case producing a true example of the genre.

Nevertheless Robert Liddell has managed to do so, having twenty years' knowledge of Greece to draw upon and luck enough to find, in the Morea, a field untouched since Sir Rennell Rodd and, a century before that, Leake and Gell. In all Greece, the Morea is a region apart, with its own traditions and strangely layered history. The author has not only travelled, but lived there; and as an accomplished writer is fully able to convey its abiding magic. But Liddell is far from being the exuberant and all-embracing philhellene of whom he gives such a devastating picture in his first chapter. He is a discriminating partisan; and as ready to tell you where, and where not, to eat and sleep, as to give you the benefit of his loving scholarship. G. A. LANGDON

THE HILLS OF ALENTEJO. By HULDINE V. BEAMISH. *London: Geoffrey Bles,* 1958. $8\frac{1}{2} \times 5\frac{1}{2}$ *inches; 224 pages; plates. 21s*

Since the war Miss Beamish has lived on a farm in the undulating cork country of the Alentejo, Portugal. The farm is the last remnant of the properties and business interests of an English family who first went to Portugal to trade in cork. The life she describes is an old-fashioned one reminiscent in some ways of rural England of the eighteenth and nineteenth centuries. Miss Beamish enjoys its tranquillity and has written a pleasant, old-fashioned book about it.

Into this volume she has swept the whole community which surrounds her at Relva. She describes its characters, some with relish others with more laboured effort. She describes the day-to-day life, the domestic upsets, the harvest, the wine making, feasting and festivals. It is an omnibus, bound together by her enthusiasm for it all. Always informative, this is not a book with a theme, nor one with a message

save that Miss Beamish went in search of tranquillity, and since she so clearly enjoys the life one assumes that she has found it. It is a description of life on the farm at Relva with some excursions into the surrounding neighbourhood. No detail is too trivial, from the miller's boy who always brings his most recalcitrant mule to the use of turkey feathers for stuffing cushions. The impression given is that it was written out of love for the local people who figure so largely in it and in the hope that other people might find in reading it some of the pleasure which Miss Beamish has had from living through the events. There is every reason to think that this will be the case. The photographs are excellent and the map very helpful. R. D. HAYES

ASIA

ALEXANDER'S PATH. By FREYA STARK. *London: John Murray*, 1958. 8½×5½ *inches; 283 pages; drawings in text by the author, and plates.* 30*s*

There is a Janus-nature in Miss Freya Stark. She is capable of bringing all her wits to bear on the conquest of some stony twentieth century route, without being distracted from her bent in antiquity; and, in the resulting record, allows the past to obtrude on the present in just the proportion needed for a literary whole. This faculty has contributed as much as anything to the special quality of her writing; but in the present volume, a sequel to 'Ionia' and 'The Lycian shore,' it is allowed for the first time an indulgence which upsets the balance of the book. Though the title gives warning of a secondary purpose, 'Alexander's path' takes the familar form of a personal travel-diary: the record of Miss Stark's journey by jeep and horse along the coastline, and into the hills, of southern and western Turkey. Her photographs are magnificent; but we are short-changed in the very coin of travel narrative: those details of contrivance and encounter which delight the armchair traveller and carry him along with the author. Except for a Turkish guide Miss Stark journeys alone, with no companions but the ghosts of young Macedonian captains. Her quest is to discover in the geography of the region clues to the puzzling course of Alexander's brief campaign against the Persian naval bases; and her conclusions, fought out in prose perhaps a little less felicitous than usual, are repeated succinctly and with convincing evidence in Appendix I. But does this make the book we have been led to expect from so distinguished and so personal a writer? Driven by a compulsion not only to reconstruct Alexander's progress from Xanthus to Phaselis by the light of imaginative insight, but to present her own romantic conception of the man and his motives, Miss Stark allows the fourth century B.C. to claim too much of her for our comfort.

G. A. LANGDON

INDIGENOUS POLITICAL SYSTEMS OF WESTERN MALAYA, by J. M. GULLICK and LINEAGE ORGANIZATION IN SOUTH-EAST CHINA, by MAURICE FREEDMAN. London School of Economics Monographs on Social Anthropology, Nos. 17 and 18. *London: Athlone Press*, 1958. 8½×5½ *inches; 151 pages each; maps, diagrams, bibliographies.* 25*s*

A short review cannot do justice to 'Indigenous political systems in Western Malaya,' a scholarly book by an author long resident in Malaya and trained in anthropological method. Fortunately ample documentary sources make possible an accurate reconstruction of the political systems of the states of Perak, Selangor and Negri Sembilan as they were before the introduction of British control in 1874. The system in the three states is by no means identical, Negri Sembilan, with its matrilineal tradition, differing widely from the other two, which in turn differ somewhat from each other. Yet a certain general uniformity emerges. At the head of the state and its very embodiment was the Sultan, sacrosanct, but often without real power, which lay with the District Chiefs. These often attempted to destroy the individual Sultan, but never the sultanate, without which the state would cease to exist. Below the Chiefs were the headmen of villages strung out along the river banks and varying in size from three houses

to a hundred or more according to the amount of land available for rice cultivation. A state being typically the basin of a large river and movement being impossible except by water the capital was invariably at the mouth of the river, where alone it was possible to control all entering or leaving the state. This was particularly important for the levy of taxes on tin mined and exported by Chinese immigrants. The mining communities were left to manage their own affairs and no effort was made to incorporate them in the state system, but the taxes on their tin made up a high proportion of the state income.

The material he collected in 1949 and 1950 during a field study of family and marriage among the Chinese of Singapore aroused Dr. Freedman's interest in the nature of Chinese society in the provinces of Fukien and Kwangtung, the homeland of the Chinese of South-east Asia. As the Communist regime makes field-work in these provinces impossible the author of the second of these two monographs has been compelled to rely entirely on written material, which is scanty in relation to the size and population of the area. Nevertheless his experience and familiarity with modern anthropological technique enables him to throw much light on the tendency, particularly noticeable in Fukien and Kwangtung, for lineage and village markedly to coincide, so that many villages consist of single lineages or, in other words, of families of the same surname who would invariably take as brides women of other villages and surnames. This tendency has its effect on land tenure, social differentiation, economic control, religious ritual and every walk of life. Not that the effect is always the same, as Dr. Freedman shows in his final chapter by his construction of imaginary villages A. and Z. at the opposite ends of the scale of social differentiation.

This brilliant example of modern anthropological method, though by no means light reading, is of considerable general interest, especially in relation to the important Chinese communities of South-east Asia. As for China itself, one wonders whether the steam roller of Communist uniformity will obliterate this elaborate, ancient and eminently practical system.

J. P. MILLS

MALAYA. Edited by NORTON GINSBURG and CHESTER F. ROBERTS, Jr. *Seattle: University of Washington Press*, 1958. $8\frac{1}{2}\times5\frac{1}{2}$ *inches;* 533 *pages; maps, diagrams and tables.* $6

The editors of this book see it as "an attempt to provide a descriptive and analytical basis for understanding a new Malaya about to embark on an unpredictable course of independence." One of them is a geographer, the other a student of international relations. Their book grew out of a research project undertaken at the University of Chicago by geographers, historians, anthropologists, sociologists and others; it is published under the auspices of the American Ethnological Society.

This book, then, is not a geography book, though it contains much first-class geography and should, all of it, be read by every geographer interested in Singapore and the Federation of Malaya. It begins with a useful introduction to the Malayan physical environment (it is good to see that the editors do not fight shy of an encounter with tropical soils) and goes on to cover such topics as the historical evolution of the states and societies of Malaya; the demographic and settlement patterns; communications; the characteristics of the major communities; and the economic and political systems. It ends with a most useful recapitulation of the main points that stand out in the work as a whole.

Much of all this, of course, is not and does not claim to be original research. It is a mark of the skill of the authors and editors that most of the sections that do discuss new investigations are satisfactorily integrated into the book as a whole. (But it must be confessed that certain of these sections, such as those on the "literacy communities" and the "mass media" (Chap. 6), though interesting, seem to be in the nature of research papers and leave one momentarily wondering whether this is indeed a general guide to the new Malaya).

There is usually great sureness of touch, though there are a few lapses: Tamil,

Telugu, Punjabi and the rest are assuredly languages, not dialects (p. 139); and the reasons for the emigration of South Indians to Malaya are somewhat superficially discussed (p. 320).

The style is generally pleasant and remarkably free from jargon. One must, however, rebel at "suburbanization" (p. 51), and Chapter 6, as the most sociological, is not surprisingly the most jarring in its use of the English language. But these are small things, and the book succeeds in leaving an impression of work well done, of useful reading for the student wishing to be introduced to Malaya, and of a group of American authors who have been critical but fair about British imperialism.

B. H. FARMER

LAND USE IN HONG KONG AND THE NEW TERRITORIES. By THOMAS R. TREGEAR. *Hong Kong: Hong Kong University Press;* and *Bude; Geographical Publications Ltd.*, 1958. Monograph 1 of the World Land Use Survey, distributed outside Hong Kong by Macmillan, London. 11 × 8½ *inches; 75 pages; maps, diagrams and photographs.* 12*s* 6*d*

Dr. Tregear's work is doubly to be welcomed; firstly because of its own intrinsic merits, and secondly because it is the first monograph to appear in the series planned by the World Land Use Survey and edited by Professor Dudley Stamp. Geographers and others are already in Dr. Tregear's debt, for in 1955 the Hong Kong University Press published his land use map of Hong Kong on a scale of 1:80,000. This map is included in a folder attached to the monograph under review, which discusses in detail the facts shown on the map, with the help of additional material from a cadastral survey of all agricultural land carried out by the Hong Kong Department of Agriculture, Fisheries and Forestry.

Dr. Tregear is to be congratulated on many aspects of his work. He modestly proclaims that his primary purpose is "to provide the planner and administrator with as accurate information as is available at present and also to direct his attention to the sources from which fuller information can be obtained" (p. 2). But the monograph will interest many who have no concern for the administration and planning of Hong Kong; for it is, in fact, a very useful contribution to the growing body of literature on the agriculture of tropical and "under-developed" regions. Moreover, Dr. Tregear's primarily descriptive aims fortunately do not prevent him from making many valuable critical comments.

The work begins with introductory chapters on the historical, social and physical setting, and then discusses the classification of land in, and the agriculture of Hong Kong, the role of climate, soil, water and communications being singled out for separate treatment; finally there are sections on marketing, rural social conditions, fisheries in relation to land use, and possible future developments.

The whole is written in a readable, jargon-free style, includes some attractive phrases and turns of speech, and is well illustrated. Possibly not all of the facts covered by the discussion of the physical setting satisfy Dr. Tregear's own admirable criterion, that "we are concerned with the geology of the colony—in fact with all physical phenomena—only in so far as it affects land use" (p. 5); and possibly the author is, here and there, a little too obviously the European looking at Asia; but these are small blemishes on an admirable piece of work.

B. H. FARMER

TRAVEL IN ASIA

VIEW TO THE SOUTH-EAST (*Gollancz*, 1958, 16*s*) carries a sub-title "A holiday tour to the Philippines, Vietnam, Cambodia, Laos, Thailand, Singapore, Indonesia, Bali, Burma and Ceylon," which accurately describes this very readable collection of magazine articles. The whole makes an excellent guide book—except that the sordid subject of prices is omitted. Nor are politics discussed except incidentally. The author, Santha Rama Rau, describes her book as an attempt to fill the gap between

detailed, specialist literature and tourist pamphlets, and a very successful attempt it is. She travelled with her husband, who is also a writer, and her small son, and was careful to avoid, as far as possible, towns and hotels of a cosmopolitan character. Thereby she was able to see and record the distinctive characteristics of each country she visited. Her book contains nothing very new or very profound, but it is packed full of information recorded with great charm.

In TEMIAR JUNGLE (*Murray*, 1958, 18*s*) John Slimming writes in great detail of a small area of Malaya, a country hardly touched by Miss Rau. Before the war very little was known of the aborigines of Malaya, but from 1948, when operations against the Communists began, they became important. The Malays had always despised the aborigines and had naturally been disliked by them in return. The Communists, on the other hand, realizing their usefulness to them, offered them their friendship, which they readily accepted, probably in most cases never understanding that their friends were not still fighting the Japanese. They served as guides, messengers, porters and growers of food for the terrorists, and in effect formed a screen through which our offensive patrols had to pass, only to find that the enemy had been warned.

In 1956 the author, an Assistant Protector of Aborigines, was deputed to obtain more information about the group known as the Temiar-Senoi, and in particular to ascertain whether they were growing crops far in excess of their own requirements for sale to the Communist bands. The home of the Temiar is in Ulu Kelantan in northern Malaya, east of the main range and north of the Cameron Highlands and the investigation involved visiting every longhouse in the area and assessing the acreage under cultivation. Fort Chabai, the permanent outpost in the Temiar country, can be reached by air, but the country round must be explored on foot or by boat or raft. This meant two journeys of about three weeks each under very arduous conditions, with an excellent Sikh field assistant as the author's only companion. A very good map makes the route easy to follow. The two men, necessarily travelling light, slept in Temiar houses and ate Temiar food. The book is based on a very full diary, often quoted verbatim, and the author's account of the Malayan jungle and its primitive people, observed closely and at leisure, could not be bettered.

SECRET LANDS WHERE WOMEN REIGN (*Hale*, 1958, 21*s*) is something of a misnomer, for the lands are not secret and women do not reign in them. The Khasi and Garo Hills in Assam are easily reached by car, the mode of transport used by Gabrielle Bertrand, the author, and though a matrilineal system obtains in both areas such local government as there is is in the hands of men. It is to be feared that the title illustrates the misstatements which mar this book.

From Gauripur in the Goalpara district of western Assam Mlle Bertrand took her truck to the Garo Hills, where she made some side trips on foot. Thence she motored to Shillong, the headquarters of the State of Assam, in the Khasi Hills, and after more side trips went on to upper Assam, where she was able to pay a short visit to the Apa Tani valley in the Himalayan foothills.

For her accounts of customs she had, naturally, to rely on informants, whose standard of veracity unfortunately varied while her appetite for the sensational remained constant. For instance the Garos are described as headhunters today and the author states that in 1916 an official found a collection of 200 skulls. Actually headhunting became extinct in 1876 and it was in that year that the skulls were found (Playfair—'The Garos,' p. 78). It is only charitable to suppose that the author made a mistake in her notes. Or again, Khasi murderers are not beaten to death by their fellow tribesmen; they are tried at Shillong, with able lawyers appearing for the defence and prosecution. Nor was it the University of London, with whom he had then no connection, who deputed an eminent anthropologist to visit the Apa Tanis. It happened to be your reviewer who did so. Obviously another instance of muddled notes. Numerous misprints and spelling mistakes are a further fault. But the photographs are excellent and the style easy, and the book will please readers who seek excitement rather than information.

Peter Holmes, the author of MOUNTAINS AND A MONASTERY (*Geoffrey Bles*, 1958, 21*s*), and his small party entered Spiti from Manali and, making their way up the Chandra river, over the Kunzum La and down the Spiti river, stayed for a considerable time at Ranrik. The expedition was assisted by our Society and the Everest Trustees, with cartography as its main scientific object, but this popular account is chiefly concerned with a general picture of the country and its people. An excellent description of a remote land scorched and arid for four months of the year and snowbound for eight, and of river beds so deeply sunk that only one acre in a thousand can be irrigated and cultivated, is followed by one of a marriage system which controls the birthrate by allowing only eldest sons to marry. Some rather unfortunate attempts on "Indianization" have been made from Delhi and the author seriously thinks that the future of these hardy Buddhist peasants may well lie in the hands of Shiring Dawa, a truly remarkable boy who has steadfastly refused to accept the normal fate of younger sons and remain a prisoner for life in a decadent monastery. Finally the author and his party forced their way up the very difficult Rabang Gorge and from a pleasant base camp did some useful climbs. A gay and witty style cannot conceal great courage and toughness and keen powers of observation. The excellent photographs, mostly of people rather than terrain, embellish a good and useful book. J. P. MILLS

AFRICA

ADAMAWA PAST AND PRESENT. By A. H. M. KIRK-GREENE. *London: Oxford University Press for the International African Institute*, 1958. $8\frac{1}{2} \times 5\frac{1}{2}$ *inches;* 230 *pages; maps.* 35*s*

In the early decades of the present century, at the time of the foundation and establishment of British rule in Northern Nigeria, it was not uncommon for administrative officers to write of the lands and people with whom they worked. Papers and books in the fields of anthropology, political institutions and linguistics appeared and the names of Palmer, Temple and Meek, among many others, spring to mind. In more recent times such contributions have been rare and though there may be good reasons for such a situation it is nonetheless regrettable. Mr. Kirk-Greene is an exception and his work on Northern Nigeria, of both an academic and more popular nature, during the present decade has been most welcome. The same may be said of his study of Adamawa Province, one of the twelve major administrative divisions of the North. It would be very good to think that there were similar volumes in preparation for the others. This is a useful guide to those who, for any reason, may find themselves newly arrived in Adamawa, conveniently enabling them to become acquainted with the background to their work. After rather brief notes of general description and on tribal groups, the main emphasis is on "the past"—exploration, the activities of the Royal Niger Company, the British occupation, etc. Attention in these chapters is focused on the European connection with Adamawa, though the balance is adjusted somewhat in later chapters which give the history of each Division of the Province. Here there is information concerning the people of Adamawa, both Fulani and Pagan. Surely there should be more. The several appendices vary in their interest and value. It is doubtful if the Nigerian administrator of the future will be greatly interested in the past movements of the provincial headquarters. The five maps are all very worthwhile, but for the price of the book a few photographs might have been included. Perhaps it is inevitable, in the nature of the work, that it should be rather pedestrian, seeming to lack a little of local colour. R. M. PROTHERO

LAND AND POPULATION IN KATSINA PROVINCE. By A. T. GROVE. *Kaduna: Government Printer, Northern Nigeria*, 1957. $9\frac{1}{2} \times 7$ *inches;* 57 *pages; maps and diagrams*

Mr. Grove's studies of land and population in Nigeria and related problems of erosion and conservation are well known. They have been supported by the Geological

Survey of Nigeria and by the Department of Agriculture of the Northern Region. Each of them demonstrates the practical value of the approach of a geographer to some of the most pressing problems of tropical development. Here are presented some of the basic facts and problems of population/land relationships in detail for Bindawa village but set in turn within the wider context of Dan Yusufu District and Katsina Province. Population distribution, historical influences, rainfall variability, agricultural practices, geology and water supply are related in a complex pattern. They are treated in this report with due recognition of this complexity. Here is no conventional formula of treatment—relief, climate, soils, vegetation, history, etc.—which can only fail to show relationships. The type of synthesis which Mr Grove achieves is the one for which geographers should aim, remembering that different areas and circumstances require individual consideration. From this synthesis it is possible for him to draw certain conclusions and to make practical suggestions. The techniques used, while not exclusive to the geographer, are those which we commonly use. One only wishes that they were more widely practised in the tropics. The text has been derived from an analysis of the maps and diagrams, many of them compiled in the field. Mr. Grove's time there was limited but he shows what may be achieved nevertheless with an adequate preparatory study of air photographs and the construction of maps from them to serve as a basis for work. Far more than by any lengthy quasi-philosophical discussion he has shown in this report the value of a geographer's contribution to knowledge by going out and completing a worth-while piece of work *in the field*.

R. M. PROTHERO

STUDIEN ZUM VOR- UND FRÜHGESCHICHTLICHEN LANDSCHAFTSWANDEL DER SAHARA. By K. W. BUTZER. *Wiesbaden: Franz Steiner* for the *Akademie der Wissenschaften und der Literatur in Mainz*, 1958. 10×7 *inches;* 49 *pages*, 8 *maps*. D.M. 4.80

In his first essay Dr. Butzer minimizes the influence of climate upon the history of the Near East. Indeed, he asserts that, since a "subpluvial" from about 5000 to 2400 B.C., there have been only slight climatic fluctuations not worthy the name of change. Most of the deterioration in the frontier provinces of the late Roman Empire he puts down to the decay of settled government and the consequent irruptions of Bedouin. A great and growing drop in the water table is also having its effect. All this is trite; what is new (and welcome) is Dr. Butzer's explanation of the last subpluvial as due not simply to a southward extension of the winter Mediterranean rainfall, nor to a northward advance of the summer monsoon rains, but to the two in combination. He utterly rejects the old idea of a "wandering Sahara," that is, the swinging of the two desert bands round the earth towards and away from the Poles. Dr. Butzer does not say so; but his new idea not only involves summer and winter migrations of animals and their hunters "following the rains" towards the central Sahara but suggests, too, the former existence of a zone, somewhere round about the Tropic of Cancer, where the summer and winter rainfalls overlapped to render permanent settlement by animals and men possible. This optimum zone would change abruptly and tragically to one of least rainfall so soon as the winter and summer rainfalls retreated northward and southward respectively. Such a theory does give a much-needed explanation for the perched aquifers at Abraq and Abu Sa'fa in the Eastern Desert, at Kurkur and Dunqul in the Western and the undoubted former existence of similar aquifers at 'Uweinat and the Gilf Kebir. It is corroborated by the discovery of the dried-up corpse of an elephant by the 1933 Bagnold expedition near Sandara Hill. This brings us to Dr. Butzer's second paper on the ecological significance of the many animal rock pictures in the eastern Sahara. Herein he plots the occurrences of rhinoceros, elephant and giraffe in the drawings, assesses the minimal rainfall necessary to sustain such creatures at 6, 4 and 2 inches annually and draws tentative isohyets through the precipitation values thus obtained. The method has its dangers; for an artist may travel a long way before he stops to picture his subject. Pictures of Nile boats and

hippopotami help to confuse the issue. But, if you have enough pictures (and there are a great many), a vague idea of the former climate does emerge. G. W. MURRAY

MEN AGAINST THE DESERT. By RITCHIE CALDER. Second edition. *London: Allen and Unwin*, 1958. $8\frac{1}{2} \times 5\frac{1}{2}$ *inches;* 208 *pages; sketch-maps and plates.* 18*s*

The pressure of a rising world population increasingly focuses attention on the development of the semi-arid and arid lands, and this new edition of 'Men against the desert' aims at bringing to a wider audience details of current activities in North Africa and the Middle East. Eight years ago Mr. Ritchie Calder was invited by Unesco to survey the desert problems of these areas; his reconnaissance anticipated the work of the Unesco Advisory Committee on Arid Zone Research and also provided the basis of a fascinating narrative which forms the first part of the book. The deserts visited are rich in classical, Biblical and modern history and the rise and fall of at least fifteen civilizations and empires are known. Mr. Calder draws upon this great past and his own field observations of modern problems to produce a travelogue that holds the reader's attention from the first page. To this vivid and imaginative account of a journey of some 15,000 miles there has now been added a set of supplementary chapters which detail the achievements of the intervening years and attempt a reappraisal of some of the more controversial problems.

Water is the main problem, for without it life cannot exist; but, as experience in Arizona and elsewhere has shown, lack of precipitation does not necessarily mean that an area is useless. Control of neighbouring surface waters, local ground water, dew deposition, and demineralization of salt water on coastal sites are nowadays practical propositions that can often be employed to remedy deficiencies. The local climatic limits need not be regarded as absolute. Almost as important as the problem of water is that of power. Man and a mule can achieve but little in these days of technological progress. But oil is often readily available in the semi-arid regions, and ingenious schemes for the development of hydro-electric power by diverting sea water into inland depressions below sea level are also being investigated. The need for education is further apparent, for although science may well show how the desert can be made fully productive the problem of the nomadic tribes with their age-old legal rights and out of date customs has yet to be surmounted.

The text of the book is supported by a selection of photographs taken by Kleboe of *Picture Post* fame, and also by a welcome series of sketch maps which pin-point for the reader his position as the narrative unfolds. Mr. Calder has a unique style of writing, and this blend of an adventure story and a scientific enquiry combines with the historical background to produce a fascinating book that is both informative and thought-provoking. W. G. V. BALCHIN

BANKERS AND PASHAS. By D. S. LANDES. *London: Heinemann*, 1958. $8\frac{1}{2} \times 5\frac{1}{2}$ *inches;* 354 *pages; illustrations.* 30*s*

To understand the political geography of the Middle East, it is necessary to have, as a background, some knowledge of what took place, in Egypt particularly, in the nineteenth century. While the opening up of the provinces of the Ottoman Empire may be said to date from Napoleon, the key to the break-up of the political and economic system of the Empire can probably be found in Egypt in the 1860's. The early years of the reign of the Khedive Ismail coincided with the drastic reduction in the supply of raw cotton from America, and with the digging of the Suez Canal. Egypt, under a viceroy who became increasingly susceptible to the blandishments of European financiers, was suddenly thrown wide open to the effects of Western economic expansionism. This expansionism was without political responsibility, and the price of it is still being paid by both Egypt and the West. The immediate results were the Egyptian cotton trade, and the opening of the Suez Canal.

'Bankers and Pashas' is the story of the impact of the international finance houses upon the economy of Egypt in the 1860's. The bankruptcy of the Khedive, the control

of the Egyptian debt, and eventually the effective occupation of Egypt by the British all followed inexorably from this exploitation. Professor Landes describes this exploitation through the medium of the correspondence between an enterprising Frenchman, Édouard Dervieu, who became the private banker to the Khedive, and Alfred André, a partner in one of the most respectable finance houses in France. The book is profusely documented and elaborately detailed. It paints a vivid and rather shocking picture of the financial transactions which brought disaster to Egypt. The ultimate benefits conferred on Egypt by Lord Cromer form no part of the book. 'Bankers and Pashas' is essential reading for anyone interested in the present state of the Middle East. The serious student who is not primarily an economist should not be put off by the fullness of the documentation, which is mostly confined to footnotes, and the narrative reads easily. The book is well indexed, beautifully printed and produced, and is a model of what such books should be. It has nine photographic illustrations.

W. P. G. THOMSON

AFRICAN TRAVEL

BLACK STAR RISING (*Herbert Jenkins*, 1958, 21*s*) is an account of a journey made through Dahomey, Togo and Ghana by Russell Warren Howe. The author, though an Englishman, has lived for some years in France and has a considerable knowledge of French language, culture and colonial affairs which enables him to make some interesting comparisons between English and French colonial rule in West Africa.

Mr. Howe's description of the actual journey cannot be called exciting, or even informative as far as the landscape is concerned. There is far too much padding of the "As *I* sat back in the car writing notes and eating a last snack" variety and one soon tires of the stops for cold drinks from a Thermos and the details of what Mr. Howe ate throughout the day. On the other hand, he himself admits that he is far more interested in people than in travel for its own sake, and his interviews with many Africans ranging from village school teachers to leading politicians form the liveliest part of the book. In his attempts to win sympathy for the African cause, however, he tends to overstate his case, and his assumption that the African inhabitants of French West Africa were living only for freedom from the French is not consistent with the results of the recent referendum when Guinea alone opted for independence.

BLACK MAN'S PALAVER, by Isobel Ryan (*Cape*, 1958, 18*s*), is also set in West Africa, but deals with life in a single town, Lagos. Though Mrs. Ryan's canvas is on a small scale her picture is well drawn. Her husband, who made the attractive line illustrations to the book, was in Lagos to establish a base for a timber business, and Mrs. Ryan's contacts with Nigerians were those which might be expected of a housewife leading an ordinary life in rented houses. In contrast to Mr. Howe, she is interested in her African acquaintances as individuals rather than as political entities, and she respects them sufficiently to describe with sympathy and understanding their failings as well as their virtues. Anyone preparing to visit Nigeria for the first time could learn a great deal, in a most entertaining way, from 'Black man's palaver.'

Southern Bechuanaland is the scene of THE BIG THIRST (*Robert Hale*, 1958, 18*s*), in which Cyril Kantor describes a journey by lorry with a cattle drover from Lobatsi across the Kalahari desert to Ghanzi, centre of a ranching district, and the return trip with a herd of cattle. Mr. Kantor obviously neglected to study 'Hints to travellers' before he set off. He forgot to take any bedding with him; he forgot his paludrine; indeed he would probably be the first to admit that without the hard-working and long-suffering cattle drover he would not have progressed very far. There are several big game stories, mainly dealing with lion; some chapters on various residents of Ghanzi; and throughout an uninhibited account of the varied feelings within the party. The book is illustrated by some reasonably good photographs, but a map is needed.

Mr. T. W. Lawman, author of THE LONG GRASS (*Robert Hale*, 1958, 18*s*), is now a journalist and broadcaster in the Central African Federation, but at the time of the

events described in his book he was serving as a District Officer in Northern Rhodesia. 'The long grass' is a mixture of big game stories, including an account of a tribal buffalo hunt, anecdotes from the early days of the opening up of Rhodesia, and sketches of local personalities, both African and European. A separate chapter is devoted to Sir Roy Welensky, whom Mr. Lawman evidently much admires. Mr. Lawman writes easily and manages to convey to the reader some of his feeling for the Rhodesian bush. The book is illustrated by photographs and a sketch map. JEAN ROBIN

AMERICA

LANDSCAPES OF ALASKA: their geologic evolution. Edited by HOWEL WILLIAMS. *Berkeley and Los Angeles: University of California Press; London: Cambridge University Press*, 1958. 10×7 *inches; maps and plates.* 37*s* 6*d*

The recognition of Alaska as the 49th State has caused attention to be focused on the "recreation value of Alaska's scenery" so the Federal National Park Service commissioned the United States Geological Survey, on the ground that appreciation of scenery is enhanced by an understanding of its origin, to prepare this authoritative and finely illustrated report. Four main physiographic provinces are recognized: Pacific Mountain System (with nine subdivisions), Interior Alaska and Western Alaska (three subdivisions), Brooks Range, and Arctic Slope (comprising foothills and coastal plain). The whole vast area of over half a million square miles is described in fifteen sections, following this scheme of physiographic regions, twelve authors taking part. The folding plates give a complete and detailed map cover, though on varying scales. A very interesting map is that showing the distribution of continuous, discontinuous and sporadic permafrost and its correlation with the areas covered by Pleistocene and existing glaciers. A surprising revelation is the large area which was not covered by Pleistocene ice sheets—including the Arctic slope and much of the Interior. Many of the bordering seas are very shallow and when the sea level sank 150 feet in Pleistocene times a broad land-bridge joined Asia and America; when it sank 300 feet there was a vast land area over the present Bering Sea and Arctic Ocean.

In part, the text describes real or imaginary tourist journeys, mainly by air, and it is inevitable that most of the photographs should be air views. Some, such as the magnificent group of volcanoes on Unimak Island or Mount Korovin in the Aleutians now lie on well-used air routes like that from Vancouver to Tokyo. Fewer are privileged to see America's highest peak, Mount McKinley (20,000 feet) but details of the delightful scenery of the Panhandle are familiar to the thousands of summer tourists who follow in the path of the '98 Klondike Gold Rush through Skagway.

L. DUDLEY STAMP

CANADA AND HER NEIGHBOURS. By GRIFFITH TAYLOR, DOROTHY J. SIEVEWRIGHT and TREVOR LLOYD. *Toronto: Ginn*, 1958. $10\frac{1}{2}\times8\frac{1}{4}$ *inches;* viii+248 *pages; maps and illustrations*; *n.p.*

This revised edition of a text-book on Canadian regional geography for young Canadian students, by three well-known North American geographers, is a delightful volume which cannot but fascinate any reader whatever his age. By means of a wealth of interesting material interestingly presented it portrays a vital and up-to-date picture of the increasingly complex pattern of the Dominion's cultural landscape. Hundreds of photographs, many of them in colour, and over fifty maps, many of them relatively large-scale, pin-pointing significant themes, illustrate a text which simply yet vividly weaves physical and historical threads into balanced and integrated treatments of each region. Modern developments such as Kitimat, Steep Rock Lake, the Prairie oilfields, the Dew line and Ontario's synthetic fibre industries are depicted in this setting. Three-quarters of the pages are devoted to Canada, and the remainder to an outline treatment of the United States and Alaska. The whole geographical

concept on which the book is based, summarized in the preface on geographical yardsticks, curiosity, observation and map-use, could be read with profit even by students much older than those for whom the volume is written. GILBERT J. BUTLAND

INDUSTRIAL EVOLUTION OF COLOMBUS, OHIO. By HENRY L. HUNKER. *Columbus: Bureau of Business Research, Ohio State University*, 1958. $9\frac{1}{4} \times 6$ *inches;* xxv+260 *pages; maps, illustrations and diagrams.* $4.

This thorough analysis of the factors, both internal and external, which have influenced the industrial evolution of an important city in the heart of the American manufacturing belt, is a welcome addition to the material available on the economic and urban geography of the United States. The treatment is a twofold assessment, an historical picture of the widening industrial horizon of the city from its early nineteenth century beginnings to 1953, and a systematic investigation of the bases of each industry located in Columbus, ranging from the metal processing and using and chemical industries to relatively insignificant plants such as those making glues and a variety of textiles. In each case, evolutionary or systematic, the roles of raw material resources, markets, labour supply, plant sites, capital, governmental planning and transport are carefully and objectively analysed, much of the basic data used being presented as an appendix. Of special interest is the large post-1940 increase in the industrial significance of the city, and the importance that Dr. Hunker attaches to institutional factors in stimulating this growth. Indeed, throughout the volume he stresses the strength of factors other than the traditional ones too often presumed to be all-important in their influence on industrial location.

The distributional aspect of the city's urban industrial growth is not ignored, but a short chapter with a tantalizingly brief statement on its industrial areas and only two maps of factory locations are disappointing. The translation into maps of many of the tables and paragraphs detailing the numbers, sizes, locations and movements of various industries would have converted an otherwise excellent business research monograph into good economic geography. If these distributional patterns had then been related to the city's landscape and townscapes, the urban geographer would have gained more than he does from the rather poor photographs which inadequately attempt to illustrate this theme. GILBERT J. BUTLAND

INTRODUCTION TO HISTORICAL GEOLOGY. By RAYMOND C. MOORE. Second edition. *New York and London: McGraw-Hill*, 1958. 10×7 *inches;* 656 *pages; plates and diagrams.* 62*s*

This handsome new edition of Professor Moore's book is impressive in the variety and superlative quality of its illustrations. The author claims, and rightly so, that a good deal of understanding of historical geology can be gained by studying the illustrations alone.

The reader with no previous geological knowledge will find basic principles adequately explained in the introductory chapters. Thereafter the book is concerned chiefly with North America and follows the familiar pattern of a chapter to each major division of the geological column. Typical rock successions which compose each system in various parts of the United States and variations in rock type are clearly displayed in tables of comparative vertical sections. The text is thus free from the burden of too much stratigraphical detail and concentrates on interpretation of the observed facts of distribution, lithology, fossil content, structure and igneous activity. A useful summary of the system's economic resources concludes each chapter. The two chapters concerned with events from Miocene times onwards provide a fairly detailed account of the stages in the development of present-day physiography. The historical approach to geology being essentially palaeogeographical it is to be regretted that the author apparently does not favour the use of palaeogeographical maps. Otherwise the illustrative content of the book cannot be too highly praised.

Three chapters on life in the Palaeozoic, Mesozoic and Cainozoic Eras and the numerous realistic reconstructions of past environments give a vivid picture of the progression of life through geological time. An appendix on the characters of organisms represented among fossils attempts to be too comprehensive and duplicates some of the information given in other parts of the book. A little more explanation, in the appropriate chapters, of how particular groups of fossils are used to subdivide successions would have been a useful addition to the palaeontological content. Nevertheless, the dependence of historical geology on the fossil record is abundantly emphasized.

Professor Moore has produced a most attractive book presenting geology in a manner well calculated to stimulate and foster interest in the subject. It can be recommended to British students as an excellent general introduction to the geology of North America.

A. M. HONEYMAN

THE TRAVELS OF WILLIAM BARTRAM. Naturalist's edition. Edited with commentary and an annotated index. By FRANCIS HARPER. *Yale: University Press; London: Oxford University Press*, 1958. $9\frac{1}{4} \times 6\frac{1}{8}$ *inches;* lxi+727 *pages; with illustrations and facsimiles and maps.* 68*s*

The travels of William Bartram occupy a prominent place in the history of the United States, for the record of his journeys through North and South Carolina, Georgia and east and west Florida, constitutes a classic of American natural history. Bartram undertook the voyage at the request of Dr. Fothergill, of London, to search these regions for the discovery of rare and useful products of nature, chiefly in the vegetable kingdom, and set sail from Philadelphia in April 1773. His memoirs were originally published in 1791, and at once aroused considerable interest for, in addition to descriptions of the plants and animals of what was then a little known region, it contained a wealth of general information concerning the geography and colonial life of that part of the south-east United States. The present work is a fully annotated and indexed edition with maps illustrating Bartram's trails, in which special attention has been given to the correct nomenclature of the plants and animals recorded and precise information on their distribution, especially the type localities of new species.

EDWARD HINDLE

POLAR

VENTURE TO THE ARCTIC. Edited by R. A. HAMILTON. *Harmondsworth: Penguin Books*, 1958. $7 \times 4\frac{1}{4}$ *inches;* 284 *pages; maps, plates and diagrams.* 5*s*

This is something new in expedition books and a very refreshing novelty it is. The expedition is the British North Greenland Expedition, 1952–4, which spent two years in Dronning Louise Land carrying out a variety of scientific projects from a base on Britannia Sø. 'North Ice,' the official account of the expedition by the leader Commander C. J. W. Simpson, R.N., was published in 1957 and belongs to the conventional narrative school. What this book 'Venture to the Arctic' is can best be described from its own preface: "Today most of the financial support for a scientific expedition comes indirectly from the 'man in the street,' who, naturally, is entitled to know the nature of the work on which his money was spent, and the results of that research. It is to him that this book is directed. It is an attempt to tell him in a book of modest price the story of the British North Greenland Expedition from the scientists' point of view. Its object is not to delve deeply into the scientific research, but by taking each science in turn to state the problem to be investigated, describe how it was tackled and, when possible, to discuss the results that have been obtained. We have thought it essential to picture the background against which the research has been carried out, for the conditions under which work is done will affect its quality and quantity. It is much more difficult to use a theodolite at 0°F. than at 50°F. And one tends to forget, when the baker calls three times a week, that his task (which all will

admit is an essential one) has to be done on the expedition by one of the members, who in all probability could be using that time to pursue his own researches. For this reason the picture given by a bald description of the scientific results of the expedition would be nearly as distorted as that derived from the pure narrative of its travels and adventures."

Following an introduction and a chapter entitled "Background to the expedition" are sections on meteorology by R. A. Hamilton, on geophysics by C. B. B. Bull, on medical aspects by J. P. Masterton, on physiology by H. E. Lewis, on glaciology by H. Lister, on geology by J. D. Peacock, on geomorphology by P. J. Wyllie and on the finance of the expedition by R. A. Hamilton. The method of presentation described in the preface is closely adhered to by each author and proves to be most successful. It is obviously impossible in a short review to present any detailed criticism of each section, nor would this be particularly helpful to prospective readers. One can, however, warmly admire the way in which they have compressed a great deal of information into so small a space; each section is a model of clarity and selection and is further aided by a generous number of maps and figures. The book should have the widest sale among all those who take any interest in polar expeditions and, in particular, should appear in every school library. As a final recommendation it is published by Penguin Books at 5*s*, a remarkable bargain. L. M. FORBES

ANTARCTICA TODAY AND TOMORROW. By G. C. L. BERTRAM. *Cambridge University Press; Dunedin: University of Otago*, 1958. $8\frac{1}{2} \times 5\frac{1}{2}$ *inches; 28 pages; map.* 5*s*

The Antarctic, that most barren continent on earth containing no known resources of economic value, has become the scene of an astonishing activity by many nations. This activity, spurred on by the International Geophysical Year, has grown to a far greater extent, and been provided for far more lavishly, than most geophysicists could have envisaged. It should be more clearly recognized that a new era has opened in the Antarctic. Quite suddenly two great powers with no formal territorial claims have applied to the area their wealth of Arctic experiences and resources on a scale far greater than the five mutually-recognizing sovereign powers could contemplate.

These are Dr. Bertram's views of the present state of affairs in the Antarctic, which he reviewed and analysed in a series of lectures at the University of Otago, and are now published in this booklet.

The first section considers the motives—adventurous, economic, scientific and strategic—of the present operations of the participating nations. Many will agree that science is not the only motive though it may be the ostensible one. Of the United States the author says "it is the apprehension lest any other power should physically come to dominate this last continent whose potentialities for good or ill are yet unclear," and of Russia, that there are clearly political aims intermixed with strategy, though the expressed motive is science. Bertram concludes that the political situation in the Antarctic is unstable, that the post-war realignment of national powers and resources is now extending to the area, and that the time is ripe for realism and reappraisal by the sovereign powers.

The final section presents a reappraisal and considers possible future regimes which might be acceptable to all nations. The author has a poor opinion of the way Britain handles her responsibilities through a tropical department of the Colonial Office and he emphasizes the weak position of all five sovereign powers on account of the greater scale of activities of other nations. There is a strong case for the British Commonwealth powers to take the initiative by engaging in detailed discussion and evolving a Commonwealth policy of territorial and political arrangements in the Antarctic. Bertram quotes extensively from a paper by Dr. C. Wilfred Jenks when discussing possible future regimes. These include: (1) recognition of existing claims, (2) sale

of territory, (3) Condominium, (4) trust territories, and (5) the functional approach. The latter regime will attract the scientist. It envisages a territory where the various technical needs and arrangements become the responsibility of existing international technical organizations (*e.g.* International Civil Aviation Authority, World Meteorological Organization) under a general blessing from U.N.O. and a code of law for the transient inhabitants developed along the lines of maritime law.

It would be valuable to have this booklet published in a more popular and accessible form so that the general public can form its opinions about the future arrangements for Antarctica. W. H. WARD

OCEANS

THE ATLANTIC. By LEONARD OUTHWAITE. *New York: Coward-McCann; London: Constable*, 1958. $8\frac{1}{2} \times 5\frac{1}{2}$ *inches; 480 pages; maps and charts.* 30*s*

Reading this book reminds one irresistibly of the story of the German scholar who started to write a history of his native town, decided that this would be incomplete without a history of the district, and then felt that that, in turn, required a history of Germany, and then a history of Europe and finally a history of the world. The author, an American with considerable nautical experience, feels that the general public, thinking in terms of eastern and western hemispheres, does not realize the importance of the Atlantic as the central link of western civilization; and he has therefore set out to illustrate fully its geographical, historical and economic importance. To do that he has felt it necessary to summarize a great part of the history of exploration, of colonization, of shipbuilding, of naval warfare, of whaling, of the slave trade, of aviation and a number of other subjects; and the result, aided by a style which is, to put it mildly, not concise, is a very large book, full of information of a surprising variety, ranging from statistics of the Black Death to the balloon of the brothers Montgolfier and from the battle of Lepanto to the navigational methods of the early Polynesians.

The information, when tested, has been found usually (but not invariably) accurate, though the author, who has a theory that the knowledge of America gained by the Norsemen was not wholly lost by the time of Columbus, makes some dubious statements in support of this, asserting, for example, that "at the end of the fourteenth century" the Basque whalers "had extended their operations as far as the coast of Newfoundland." There is, too, a strange discrepancy between his map of Atlantic drainage, which excludes that of Hudson's Bay, and the letterpress which, quite rightly, includes it. Errors of this sort, however, are not numerous; and altogether the book can be read with profit once it is realized that a great deal of it has not much more to do with the Atlantic than with the rest of the world. L. COLLIER

MOUNTAINS IN THE SEA. By MARTIN HOLDGATE. *London: Macmillan*, 1958. $8\frac{1}{2} \times 5\frac{1}{2}$ *inches; 222 pages; maps and plates.* 25*s*

It would be difficult to find a more appealing target for a small scientific expedition than that of an uninhabited island separated from the nearest major land mass by 1500 miles of tempestuous sea in the zone of the "roaring forties," yet possessing a climate temperate enough to support a lush vegetation as well as a rich abundance of bird and animal life. Gough Island, the subject of this book, is in reality the "worn-down stump" of a volcanic peak rising 10,000 feet above the level of the surrounding ocean floor with less than one-tenth of the mountain exposed above the sea. The greater length of the coastline rises abruptly in cliffs up to 1000 feet in height at the base of which vast masses of rock lie piled in a disorderly heap. "You might come to such a place, and only the pungent smell would tell you there were seals about. You could then clap your hands, shout or knock two pebbles together, and the rocks would explode with seal."

The story begins in Cambridge where a group of nine young scientists engaged in post-graduate research plan to spend six months in making a complete study of the island including its geology and topography, its climate and flora and fauna. The start of the venture is dogged by misfortune—John Heaney, the leader and organizer, is prevented by illness from going at the last minute; Robert Chambers, who takes his place, has no sooner landed on the island that he succumbs to a slipped disc and has to be immediately evacuated; the author then takes over direction of the party as the third "nigger boy" and from then onwards all goes well.

After leaving Cape Town the expedition was first landed at Tristan da Cunha where the party spent several weeks waiting for a ship to take them on to Gough. This beautiful island with its isolated community of hardy fishermen made a deep impression, and the author writes with warmth of feeling and understanding of their simple existence, and of the kindliness and hospitality with which the Tristan islander treats his visitors.

A landing is finally made on Gough Island in November, 1955, and a permanent base hut is constructed just above the landing beach in a sheltered valley known as "The Glen." Working mainly from this static base, the party set about exploring the island, each man concentrating on his special task, assisted by one or other of his companions and two of the Tristan islanders who volunteered to join the expedition. The author deals separately with each phase of the work, combining scientific fact with a mixture of anecdote and humour which makes the book easily readable even to the non-scientist. There are no great hardships (beyond wet feet!), no spectacular climbs, and the worst catastrophe appears to have been the loss of a tent left unoccupied in a high wind. The reader is nevertheless held fascinated by the wealth of interest in this little island: its complex geological history; the richness of its vegetation ("a tangle of interlacing branches and prostrate trunks"); the variety and rare beauty of its sea birds; the engaging antics of its colonies of penguins, seals and sea-elephants.

Apart from one or two rather irritating mannerisms (for instance the constant use of "now" at the start of a paragraph) this is a readable and enjoyable account of a small but successful expedition, carried out without fuss and at very little cost. The photographs throughout the book are of a high standard and the publishers deserve full credit for the excellence of its presentation. P. G. MOTT

AMONG THE SAVAGES OF THE SOUTH SEAS. By A. TETENS, translated from the German by Florence Mann Spoehr. *Stanford, Calif.: University Press; London: Oxford University Press*, 1958. 8½×5½ *inches;* 108 *pages; maps and plates.* 25*s*

Interest in the development of the island peoples of the Pacific Ocean has recently prompted anthropologists and historians to turn to nineteenth century records in a desire to illuminate the present scene. 'Among the savages of the South Seas' is the first English translation of the Micronesian memoirs of Captain Alfred Tetens of Hamburg who served aboard English trading ships one hundred years ago.

Teten's journals were collected and edited during his lifetime by S. Steinberg who published them in 1888 under the title 'Vom Schiffsjungen zum Wasserschout.' This volume is the basis of the present translation by Mrs. Florence Mann Spoehr, but she has restricted herself to the last half of the Tetens memoirs—to his account of his stay on the islands of Palau and Yap in the 1860s. Tetens was a skilled observer, and his account of the life and customs of the islanders is of particular interest because of the changes during the past fifty years; he tells of an almost forgotten way of life.

The translation is accompanied by a full introduction in which we hear of many interesting events in Tetens's long life at sea under the flags of several countries, of his opinions of Englishmen, of his reflections on the greatness of England, of customs aboard ship, and of unusual cargoes.

The book is illustrated with photographs of nineteenth century prints. Mrs. Spoehr is generous in her acknowledgement of the many who have helped her with her task—especially her son, Alexander Spoehr (Director of the Bishop Museum in Honolulu) for "his aid in annotating and authenticating anthropological and geographic details."

EILA M. J. CAMPBELL

PHYSICAL AND HUMAN GEOGRAPHY

GEOMORPHOLOGISCHE ABHANDLUNGEN: Otto Maull zum 70 Geburtstage gewidmet. Edited by E. FELS, H. OVERBECK and J. H. SCHULTZE. *Abhandlungen des Geographischen Institut der Freien Universität Berlin, Band* 5, 1957. $11\frac{1}{4} \times 8\frac{1}{4}$ *inches; 72 pages; plates, maps and diagrams*

As a tribute to Professor Otto Maull, on the occasion of his seventieth birthday, fifteen authors submitted papers for publication in Heft 3/4 of *Die Erde* (the publication of Die Gesellschaft für Erdkunde zu Berlin). It proved possible to accommodate only eight of these papers in the birthday volume and the other seven here appear together in the geographical periodical of the Free University of Berlin.

Although mainly morphological the papers deal with a variety of themes. The first two, by Professor J. P. Bakker and Dr. W. Klauer, are concerned with the weathering of granite and the development of "Karstic" forms in this rock under sub-tropical and tropical conditions. Bakker describes the solution of silica by rain-water having a high *p*H, attributed to the presence of lichens and algae. The dissolved silica is redeposited as the moisture is evaporated and helps to form a protective crust. This sequence is considered to be of importance in the development of *inselberge*.

Four papers are Alpine: slope and debris movement in the Eastern Alps; the movement of a rock stream in the Tirol; relief and vegetation of the Nieder Tauern; the Late-Glacial in the Inn valley. The last, by Professor H. Paschinger, is of particular interest since it deals with the post-Allerod ice advance (the Schlern re-advance). After the warmer Allerod period, snow level in the Inn valley fell again to some 900 metres below its present level. The debris from the re-advancing ice was piled over the Inn terraces against dead ice of the pre-Allerod period (Würm II?) still occupying the Inn valley.

In the last paper, Professor H. Lehmann considers a curious gravel horizon, seen in the Paraiba valley on an excursion during the XVIIIth International Geographical Congress. The reasoned argument about the general character of the gravel and the evidence it offers of formerly prevailing climatic conditions is representative of much modern French and German geomorphological research.

The periodical itself, of excellent presentation, is only one of many similar German publications, by means of which German geographical research is made public. The number of these periodicals and their general excellence compares very favourably with the poverty in number of such publications in this country. E. M. YATES

COASTAL AND SUBMARINE MORPHOLOGY. By ANDRÉ GUILCHER. Translated by B. W. Sparks and R. H. W. Kneese. *London: Methuen*, 1958. $8\frac{1}{2} \times 5\frac{1}{2}$ *inches; 274 pages; plates and line drawings.* 30*s*

This is a translation of Professor Guilcher's book 'Morphologie littorale et sous-marine,' published in 1954 and reviewed in this *Journal* in June 1955 by Professor Steers, the originator of this English edition. The success of the translation results not only from the author's mastery of the subject but also from the fact that one of the translators is a geomorphologist. So much work has been done since D. W. Johnson's 'Shore processes and shoreline development' was published, and especially after the Second World War, as Professor Guilcher's bibliography shows, that this excellent little book thoroughly deserves as wide a reading public as the two editions now give it. Whilst lacking the detail of Johnson's book it shows how real was the need for a new

work. For instance, almost the only detailed piece of original research in Johnson's book, that dealing with the formation of offshore bars, has been shown by laboratory studies to be inadequate. In a few terse paragraphs Guilcher pin-points the difficulty of envisaging how the relatively short, steep storm-waves can throw up a bar above sea level leaving a considerable lagoon between the bar and the dry land. This terseness is, too often, carried to an extreme so that whereas the expert may construe the meaning the undergraduate may not. Perhaps it is this attempt at brevity that leads to confusion on page 18 where the swash or uprush from a broken wave is referred to as a wave of translation, and in the next paragraph is the sentence "The wave of translation breaks again after its first uprush." There has been serious confusion in the use of the term "wave of translation" ever since Johnson misapplied Scott Russell's use of the term. Scott Russell applied it to an oscillatary wave that actually broke on a shoal; the wave-crest is then thrown forward into the trough thus giving rise to a wave of translation which consists solely of a wave-crest above the still water level. Johnson states without any justification that a wave of oscillation changes to a wave of translation on approaching a gradually shelving shoreline—without breaking. He further damages his case by attributing the constructive action of waves on a foreshore to their being, at least in part, waves of translation. It has long been known, as Professor Guilcher points out, that small waves are constructive compared with large ones, but Professor Guilcher himself does not make clear—as laboratory studies do—that flat waves are constructive compared with steep waves of the same amplitude. Further study of these matters is required especially as sand and shingle react differently to waves of the same type. However, appeal to waves of translation will have little or no part to play in such investigations, and the term should be dropped, at least until it is better understood.

But these criticisms refer to only a small part of Professor Guilcher's book. He brings together much that is quite new, as in his excellent section on solution effects on the foreshore—an unduly neglected aspect to which Professor Guilcher has made original contributions. He handles sensibly the thorny problem of classification of coasts, and in his final chapter is an up-to-date summary of the origin of the features of the deep-sea floor.

The book is well produced with excellent photographs, good diagrams, though some are too cramped, excellent chapter bibliographies helpfully arranged by subject, but an inadequate index.

W. V. LEWIS

EVERYDAY METEOROLOGY. By A. A. MILLER and M. PARRY. *London: Hutchinson*, 1958. 9 × 5¾ *inches; 270 pages; plates and diagrams.* 30*s*

In their introduction the authors state that their aim is to present "met. without maths." The book must therefore be judged just as much on its educational as on its meteorological validity. In the main it is strikingly successful on both counts. By skilful use of diagrams and prose of exceptional clarity, the structure and functions of the atmosphere are explained at the purely qualitative level. At the same time, deviations from scientific validity are so localized that young physicists and mathematicians could certainly read it with nothing but benefit to their subsequent modes of thought.

Methods of weather observing and forecasting are reviewed in the first two chapters. Apart from an informative description of the assembling of surface and upper-air data from a synoptic network of stations, helpful suggestions are provided for teachers who wish to operate school weather stations.

In the following four chapters, basic meteorological concepts such as atmospheric stability are explained very clearly and all the common processes such as convection, frictional turbulence, condensation and precipitation are described. The nature and origin of air masses and pressure systems are gradually made apparent and the culmination of the first part of the book is reached in Chapter 7 where these large-scale phenomena are welded together into a tentative but realistic picture of the planetary

circulation. Relatively recent meteorological discoveries such as the jet streams and more abstruse concepts such as the isobaric surface are all introduced where relevant and useful, without making the argument appear any the more difficult.

In Chapter 9 numerous aspects of micro- and local meteorology are developed, and this is followed, in Chapter 10, by a stimulating assessment of the problem of detailed forecasting. The book is rounded off with two chapters on the complementary topics of weather as a disruptive force and weather as a source of energy.

Unfortunately the book is marred by Chapter 8 where an attempt is made to classify the weather patterns of the whole earth on the basis of air mass and frontal frequency. The aim, though laudable, is far too ambitious to be achieved in one chapter and grave over-simplifications were inevitable. This cannot excuse the misconceptions and laxity of expression, however; the tone here is quite out of keeping with the precision of earlier chapters. Not only are sweeping and unrealistic statements made about vast phenomena such as the Asiatic monsoons, but these are presented with such an uncritical air of finality as to convey the impression that complete understanding has been achieved. Furthermore, traditional but misleading correlations with vegetation are implied by such sub-titles as "The savanna lands" and "Steppe climates"; even "The temperate climate" appears with no attempt at justification except that it is "well established."

Most of the book is so well conceived and informative that it should become the standard introductory reference on the meteorological basis of climatology for geography students. It is most regrettable, therefore, that the chapter to which geographers will turn with greatest interest should be so disappointing. S. R. EYRE

DIE BEVÖLKERUNG DER ERDE: Verteilung und Dynamik. By KURT WITTHAUER. *Gotha: Hermann Haack*, 1958. $7\frac{1}{2} \times 10\frac{1}{2}$ *inches;* 336 *pages; maps and diagrams, including folder*

This is both a study of world population trends and a work of statistical reference, based on official and semi-official sources. It is one of *Petermann's Mitteilungen* series. The book comprises three sections: the first is a brief review of world population; then comes an examination of its distribution and a study of population "dynamics" in modern times (*sc.* since 1650); finally there is a summary of statistics relating to the population of nation states based on the most recent census figures available. There is a useful series of coloured maps in an end folder on which the virtually uninhabited lands are tinted in pale yellow. On one of these maps the author suggests the population of major world areas by the year 2000 A.D., a theme also discussed in the text. The fact that the population of South America has increased by over 20 per cent. since 1920, Australia by 14 per cent., but that of Europe by only 5 per cent. (excluding the Mediterranean lands—9 per cent.), may well represent the shape of things to come. Again, the rapid expansion of population which is taking place in such "new" countries as Venezuela, the Federation of Malaya and Jordan, where the net rate of increase is over 28 per 1000, contrasts with the picture for Western Europe, where it is between 4 and 5 per 1000 for Great Britain, the German Federal Republic and Sweden. There are a number of ingenious logarithmic graphs, on one of which the density of population is plotted in such a way that Luxembourg appears comparable with Zanzibar, Nepal with Greece, and Jamaica with the Lebanon. The graphs which show the average expectation of life are intriguing for, apart from a general increase in longevity, it appears that whereas women may expect to outlive men in, for example, New Zealand and Germany, by a sizeable margin of years, in India and Ceylon the position is significantly reversed. Amongst the various footnotes and final list of references there is none to the official reports based on the 1951 census in Great Britain and Northern Ireland and on p. 71 the population of "England" is quoted as 51 million. No account is taken of intercensal population changes in Britain, such as were discussed by Dr. Willatts and Mrs. Newson in the *Geographical Journal*, 119

(1953). It also seems curious to include in such a general survey a dot distribution map of population in Costa Rica, based on the 1950 census (p. 301), while omitting any mention of maps showing urban distributions, such as those compiled by Professor William-Olsson for Sweden (1946) and Europe (1952). There is much material in this volume to interest those concerned with modern demographic problems and also perhaps the Commission set up by the International Geographical Union to map the world's population.

A. F. A. MUTTON

NATURAL HISTORY

ELEPHANTS. By RICHARD CARRINGTON. *London: Chatto and Windus*, 1958. $8\frac{1}{2} \times 5\frac{1}{2}$ *inches; 272 pages; plates and drawings.* 25*s*

Elephants have come to occupy almost as prominent a place in the accounts of early travellers in Asia and Africa, as penguins in Antarctica, and throughout the ages they have always aroused a special interest. This gigantic animal has played a part in the history of religion, war, art, and even music, and for more than 3000 years has ranked with the horse, the dog and the camel as a faithful servant of man. The author gives a most entertaining account of the elephant's natural history, evolution and influence on mankind, which will appeal to the specialist as well as to the general reader. The book is divided into three parts, "Elephants as animals" devoted mainly to their zoology; "Elephants as fossils" dealing with their evolution; and "Elephants and man" concerned primarily with the different roles played by elephants in the history of man himself. The many illustrations by Maurice Wilson and others, add considerably to the interest and value of this survey, and Mr. Carrington's book can be thoroughly recommended to those who like to combine instruction and entertainment.

EDWARD HINDLE

BIOGRAPHY

JOURNEYMAN TAYLOR: the education of a scientist. By GRIFFITH TAYLOR. Abridged and edited by Alasdair Alpin MacGregor. *London: Robert Hale*, 1958. $8\frac{1}{2} \times 5\frac{1}{2}$ *inches; 352 pages; diagrams and plates.* 25*s*

No serious geographer should miss the opportunity of reading Griffith Taylor's autobiography—the life seen by himself of one of the most stimulating if controversial figures of our time. For the mind of Griff is evolution in action, producing plenty of sports destined to wither and die, plenty of sound ideas a generation before their time, still others—such as his climographs—so apt as to be absorbed immediately into current thought and literature.

Cockney by birth, pseudo-Serb, Australian and Cantabrigian by education, he was successively—*inter alia*—Antarctic geologist, government meteorologist, professor of geography at Sydney (founding a new department), Chicago and Toronto (another new department). Through his forthright but unpopular frankness about the difficulties ahead of Australia in white development of the tropics and the desert he was so vilified by the Press as to be almost literally hounded out of the continent, only to become thirty years later the first and only geographer Fellow of the Australian Academy of Sciences.

An autobiography has the advantage over a biography that it leaves the reader free to make his own assessment of character and achievements. This is particularly so in the present case since the record is based on diaries kept meticulously year after year, and is strictly factual, rarely subjective. The great exponent of determinism is seen himself to be the product or victim of possibilism, his life shaped by series of accidental happenings. The casual invitation which led to his early work as senior geologist to Scott's Antarctic Expedition (1910–12) resulted in life-long friendships, in marriage with Raymond Priestley's sister Doris, and indirectly to the Presidency of Section E of the British Association. Unimaginative regulations of Exhibition Comissioners led to two years work on the *Archaeocyathinae* at Cambridge, where there was no great

interest in the project, but afforded opportunities for the insatiable curiosity and urge to travel which took Griffith Taylor to each of the seven continents before he was forty. With him education has never ceased: in an exploratory spirit he has dipped into almost everything. We find him learning French, German, Spanish, Malay, Japanese and, later in life, Russian, to equip himself for travel done the hard way—on foot, with heavy rucksack and stout boots, food and lodging on the barest scale. To go on a field trip with Griff—as I did first in Australia in the twenties—was an unforgettable experience. Four and a half miles an hour was normal walking: before the ordinary mortal had time to note the details of one objective he would be half way to the next, yet all would be recorded in his own note book, often with details the slower observer had missed. This amazing flair for noting essentials is seen in all his many writings; it is the essence of the highly characteristic Griffographs, if one may coin a word for those sketch block-diagrams (the autobiography fortunately has a number of them, many new) which so often convey the whole story as nothing else could do, though sometimes puzzling the reader to the point of exasperation.

Griffith Taylor is essentially an individualist of strong likes and dislikes: teetotaller, non-smoker, unitarian, cinema-addict (once a week), but TV allergic, he finds it hard to understand in others a completely different set of values. Tolerant to a certain point, beyond he has always found it difficult to do other than condemn such human failings as an ignorance of geography and a classical education, and has thus been his own worst enemy in the spread of his sound positive ideas.

It is difficult, without explanation, to see what part has been played by the abridger and editor of the autobiography, except that he has provided a large number of apparently irrelevant photographs—a great pity when there are so many facets in Griff's career one would like to have seen illustrated. L. DUDLEY STAMP

ADVENTURER'S EYE. By TOM STOBART. *London: Odham's Press*, 1958. 9×6 *inches; 256 pages; illustrations.* 21*s*

The title is apt. In 1953, on Everest, it was a favourite game to try and catch Tom out with a part of the world he had not visited and filmed. One was seldom successful. He seemed to have covered a lot of ground (and water) on very diverse assignments; and though it may seem a far cry from pursuing a love affair through war-time Europe to filming the Everest expedition, this book shows the thread running through both exploits to be essentially the same. Adventure, to Tom Stobart, meant doing odd jobs in odd places: filming penguins off Africa or rhinosceroses in it, sea lions in Antarctica or mountaineers on steep bits of ice; catching giraffes from a car or close-ups of the tiniest flower.

For the *leitmotif* giving unity to this autobiography is the passion for filming, a passion equalled only by the love of a Rumanian girl with which the travels proper begin. Tucked in between anecdote and reminiscence is much real and varied film lore, together with travel lore which may not be everybody's cup of tea. Above all, a glimpse is given of why filming in strange places is exhausting, exasperating and intensely exciting.

The Everest expedition comes as climax to the book. In the role of cameraman, not climber, Tom felt himself something of an odd man out, and there is a touch of the Angry Young Stobart out of patience with the Establishment. But it was inevitable that the Establishment should be concerned primarily with getting up the mountain; it was also financially on a tight string, and this accounted for the cut in camera-carrying Sherpas. He is unfair here, but amusing and instructive on the rest of the expedition as he saw it.

The writing does not pretend to stylishness, and that is right for this book. It is conversational, sometimes racy; almost one can hear the narrating voice. Anecdotes are pungently told and the teller is not squeamish in his choice. They range widely and often throw unexpected light on the hero—or victim. To this light the varied photo-

graphs are a necessary adjunct, but there are too many of the Everest region, in proportion to the place it occupies in the text. An occasional map would also have been helpful. WILFRID NOYCE

OF FISH AND MEN. By JON MILLER. *London: Jarrolds*, 1958. 8½×5½ *inches; 160 pages; plates.* 18*s*

One finishes this cheerful, chatty, unassuming little book with a feeling of considerable affection for the author. Though clearly an enthusiast for his subject, ichthyology, he is too modest to be a bore about it; and his account of his travels on behalf of the aquarium of the London Zoo to Russia, Czechoslovakia and Rumania shows what an amiable nature can do to overcome obstacles and make friends behind the Iron Curtain. His style is unpretentious, sometimes to the verge of naivety (he is, for example, almost as fond of exclamation marks as was Queen Victoria); but he has humour and can tell a good story, such as that of the bomb which scored a direct hit on an elephant in the Leningrad Zoo or the account of his fantastic voyage from Tulcea to Braila; and he makes his points clearly. Two of these, in particular, seem to deserve the attention of the British Government—the need to investigate the possibilities of fish-*farming* in the sea as well as in rivers, as opposed to the present system of extracting fish from the sea and putting none back again, and the need to meet the demand for British technical publications from countries with no sterling to pay for them. In the latter case all that seems required, as recently pointed out in *The Times*, is Treasury sanction for the revival of the scheme in force just after the war and now copied by the Americans, who are consequently "cornering" the market. L. COLLIER

SHORTER NOTICES

The publishers of THE GREAT MOTOR HIGHWAYS OF THE ALPS (*Robert Hale*, 1958, 30*s*) say that "this book is intended equally for pleasurable leisure-time reading, as a work of reference at home and for practical use while actually on the road". It is well suited for the last purpose and well enough suited for the second, at least as far as actual motoring information is concerned: it covers all the major and most of the minor passes and gives sound advice on how to drive over them with the minimum of trouble, fatigue and risk and how to get the best views of the scenery, for which the author, Hugh Merrick, clearly has a genuine but discriminating enthusiasm. For general reading, however, it has two defects. The first is the author's style, which has fits of journalistic jauntiness and reads at times almost as if he were retailing Hollywood gossip about the Alps: more than once, indeed, he refers to a pass or valley as being "groomed for stardom." The other and much graver defect is the lack of adequate historical treatment. One of the greatest interests of the passes lies in their illustration of the dependence of history upon geography—how, for instance, the difference between the Bernardino and the Splügen goes far to explain why the Val Mesocco is in Switzerland while the Valle San Giacomo is in Italy. Yet this relationship is hardly touched upon in the book; and such historical information as it does give is often inaccurate. It can therefore be recommended more wholeheartedly to the motorist than to the general public. L. C.

IN MUCH ELSE IN ITALY (*Macmillan*, 1958, 18*s*) the Australian novelist Martin Boyd makes his progress up the west side of Italy an occasion to resolve his spiritual problems; using as his mouthpiece an imaginary "Irish boy in search of God." An Excursion rather than a journey; and perhaps disappointing to the hopeful travel-reader in search of Italy. G. A. L.

IMATRA SOM NATURSEVÄRDHET TILL OCH MED 1870 is a study in the appreciation of scenery which employs the literature dealing with east Finland's most celebrated beauty spot—the Imatra rapids on the Vuoski river. Dr. Sven Hirn uses 63 written accounts together with manuscript material in his attempt to explain the changing approach of writers to a feature of the natural landscape. Among English sources used

is W. Fox-Strangeway's contribution to the *Transactions of the Geological Society*. The book also covers Imatra rapids in tradition, poetry and art, and it contains sixteen illustrations. It appears in *Bidrag till kännedom af Finlands natur och folk*, **102** (Helsingfors), an historical research series, and this experiment in the use of old travel literature as a field of investigation introduces a new element into its range of publications. Through such work, Dr. Hirn bids fair to maintain the tradition of his family, which is noted for its virtuosity in history and literature. W. R. M.

QUEST FOR PAITITI by Julian Tennant (*Max Parrish*, 1958, 17*s* 6*d*) is a rather naïve description of a journey in search of a legendary city. It is readable, but does not add a great deal to one's knowledge of the geography of Peru. J. A. S.

RUINS IN THE SKY by Brian Fawcett (*Hutchinson*, 1958, 25*s*) is a pleasantly written book, but of greater interest to the general reader than to the geographer. Approximately the first half deals with the author's life and experiences as a railway engineer in Peru. The remainder is concerned largely with Brazil, contains references to his father's journeys, and accounts of several flights in the north-east in search of ruins which are shown to be natural rock formations. The author's comments on people and places are pertinent. J. A. S.

A revised edition has been published of PORTS AND HARBOURS by the late F. W. Morgan, formerly lecurer in geography at the London School of Economics. This concise geographical study (*Hutchinson University Library*, 1958, 10*s* 6*d*) first appeared in 1952, and was reviewed in the *Journal* for December of that year. The new edition has been prepared for the press by Dr. James Bird, University of London King's College, who has confined his amendments to bringing the information up to date, while the layout and construction of the book are left as they were. 'Ports and harbours' has been out of print for some time and the appearance of a revised edition is to be welcomed. D. M.

W. G. Moore is the author of TRANSPORT, in the Essential Geography series of Hulton Educational Publications (1958, 6*s* 6*d* limp covers, 7*s* 6*d* bound). In it, full use is made of excellent photographs, diagrams and maps to help the pupil in understanding and remembering both the means of transport and world routes. Part I deals first with fuels, then with ships, rail and road transport, while Part II is concerned with routes continent by continent, and concludes with an account of airways. Written with clarity and vigour, the book achieves its aim of covering the essential geography of transport and can confidently be recommended for classroom use. A. C. O.

Minnesota became the thirty-second state to enter the union of the United States of America on 11 May 1858, and the centenary was celebrated by the publication of a handsome book, THE FACE OF MINNESOTA by John Szarkowski (*Minnesota University Press; London: O.U.P.*, 1958, 40*s*). Lavishly illustrated, this volume covers every aspect of the State's life, and although the absence of maps will disappoint geographers the 179 black and white and 24 coloured plates give a fine impression of the countryside and people of Minnesota. D. M.

THE SOCIETY'S NEWS

NEW YEAR'S HONOURS LIST

Major-General L. F. de Vic Carey, Director General of the Ordnance Survey and Member of Council since 1957, was made a Companion of the Bath in the New Year's Honours List; Mr. Tom Harrisson, Curator of the Sarawak Museum, and recipient of the Cuthbert Peek Award in 1936, becomes an O.B.E.; Captain M. E. Banks, a member of the British North Greenland Expedition, 1952–4, and leader of the successful expedition to Rakaposhi in 1958, receives the M.B.E. Other Fellows whose names appear in the List are Dr. N. L. Corkill, C.M.G., Mr. H. F. A. Gates, C.M.G., Mr. A. F. J. Reddaway, C.M.G., Mr. J. E. B. Finlay, C.B., and Major-General I. H. Riches, C.B.

LORD NATHAN'S VISIT TO THE UNITED STATES

Lord Nathan, the Society's President, and Lady Nathan, on a recent visit to the United States, were entertained on arrival on 13 November 1958 by the American Geographical Society in New York. The reception arranged by the A.G.S. was attended not only by their own members, but also by Fellows of the R.G.S. living in New York who were thus given an opportunity of meeting their President. "It was interesting," says Lord Nathan, "to learn how much our Fellows look forward to and enjoy reading the *Geographical Journal*." A copy of the Gough Map, published jointly by the Society and the Bodleian Library was presented by the President to the American Geographical Society. In the course of a four weeks' tour Lord Nathan also visited Montreal and Boston, and finally Washington where he received the Freedom of the City.

NATIONAL GEOGRAPHIC SOCIETY

Mr. L. P. Kirwan, Director and Secretary of the Society, has been elected an Honorary Member of the National Geographic Society, Washington D.C.

CONFERENCES HELD AT THE SOCIETY'S HOUSE IN 1958

During 1958 several outside conferences took place in the Society's House. The year 1958 was the centenary of the reading of the Darwin-Wallace paper on "Evolution by natural selection" and also the bicentenary of the issue of the 10th edition of Linnaeus' 'Systema Naturae'; on July 15 the Linnaean Society held a symposium at the Society's House, and from July 17 to 23 the XVth International Congress of Zoology used the hall for certain of its meetings.

On September 25 and 26 the Institute of Biology, as in previous years, held its annual symposium at the Society's House; the theme for 1958 was "The effects of pollution on living materials." The Chairmen at the four sessions of the symposium were respectively Professor Pearsall, Dr. B. A. Southgate, Dr. R. Lessing and Professor J. F. Danielli.

The Society were joint hosts on October 7 with the Commonwealth Institute to a conference of sixth-form children, convened to hear an account of the crossing of Antarctica. The conference was opened by the Society's President, Lord Nathan, and the speakers, Squadron-Leader J. Lewis and Mr. Ralph Lenton, were introduced by Sir Miles Clifford. In the afternoon, films were shown and questions were asked. Over 600 children attended.

SPECIAL MEETINGS AND FILMS DURING 1958

Most notable among the Society's meetings in 1958 was that addressed on May 19 by Sir Vivian Fuchs on the crossing of Antarctica. Before the lecture, Her Royal

Highness the Duchess of Kent presented Sir Vivian with the Society's Special Gold Medal; the proceedings have been fully described in the *Journals* for September and December 1958. Other special occasions have been Mr. Duncan Carse's meeting on the South Georgia Survey, Professor P. M. S. Blackett's on "Rock magnetism as evidence of continental drift," and Thor Heyerdahl's on "The enigma of Easter Island"; on April 28 Dr. Audrey Richards gave the Mrs. Will Gordon lecture, and spoke on "The changing pattern of agriculture in East Africa today." A lively discussion followed Professor W. G. V. Balchin's short paper on March 24 on "A water use survey" in Great Britain. On May 12 the Society entertained Academician I. P. Gerasimov, Director of the Geographical Institute of the Soviet Academy of Sciences, whose lecture on "Land use and contemporary geography in the U.S.S.R." (delivered in Russian) was printed in the December 1958 *Journal*. H.R.H. Prince Peter of Greece's film (October 13), "They were Kafirs," gave an interesting account of the ethnological work of the Danish Scientific Mission to Afghanistan, and on November 10 Dr. Paul Siple, Gold Medallist of the Society, showed a film of the United States "Amundsen-Scott" station at the South Pole. This remarkable film, including scenes shot during the first wintering at the South Pole, has been produced by the National Geographic Society.

UNESCO EXHIBITION: "THE EARTH AS A PLANET"

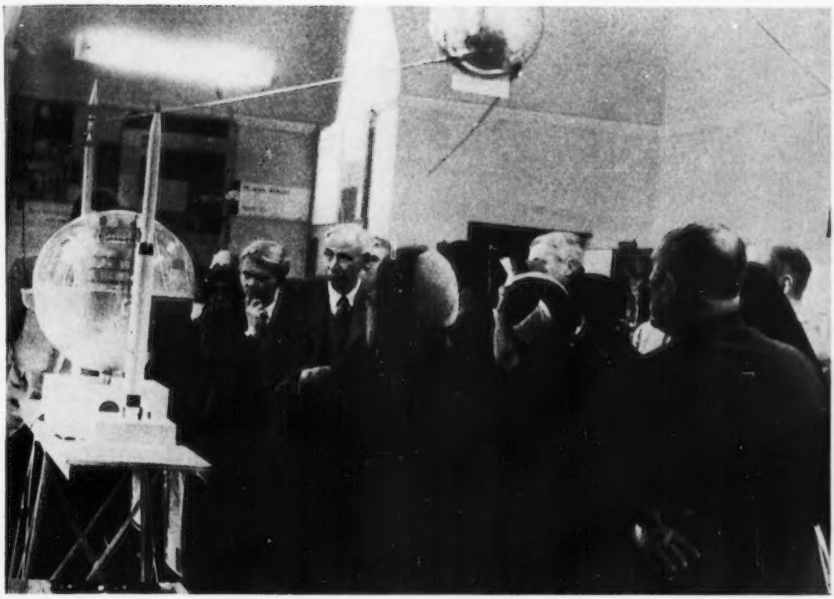
At the request of the Royal Society, and with the help of a grant from the Ministry of Education, the UNESCO exhibition "The Earth as a planet" was on display in the Society's House from 15 December 1958 to 16 January 1959. Under the constant supervision of its Director, Monsieur H. A. Diamand, the exhibition was visited by upwards of 10,000 visitors, including twenty-nine parties from schools. A team of demonstrators was recruited from students of the Imperial College of Science and Technology, and they were on duty every day to explain the working models and to take parties round.

The exhibition consisted of seven sections illustrating the scientific facts we are learning about our earth, in particular those covered by the International Geophysical Year programme. A beam of light at the entrance registered every visitor entering the first section, which was devoted to the sun's activity. Solar activity varies over an eleven year cycle and the I.G.Y. was held in 1958 because at that time the activity was at its peak. Photographs and drawings illustrated the various phenomena at the sun's surface, sunspots and prominences; and spectrometers showed how the light from the sun can be split into its various components, forming spectra which give evidence of the sun's composition. Experiments were set up demonstrating the techniques of radio astronomy, with working models of radio telescopes using the same principles as the telescope at Jodrell Bank, near Manchester.

The second section illustrated the earth's magnetic properties, beginning with experiments to show the principles of magnetism, and developing this theme as far as a proton magnetometer. Many instruments for measuring the earth's magnetic components were on display, including a magnetic theodolite, whilst photographs on the walls explained their application and showed results obtained. Magnetic storms and their association with sunspots were also dealt with in this section.

From this section one moved on to the "Upper Atmosphere." Here, one of the principal methods of investigation is by rocket, and techniques were thoroughly explained by means of exhibits, among them rockets which are launched from balloons or jet aircraft, and part of a Viking rocket was also on show. The properties of the different layers of the upper atmosphere were discussed in connection with absorption and reflection of electromagnetic waves—an experiment effectively showing the ionospheric reflection of radio waves, a process which enables radio signals to be sent round the world. Refraction by the atmosphere, which produces mirages, was also illustrated here.

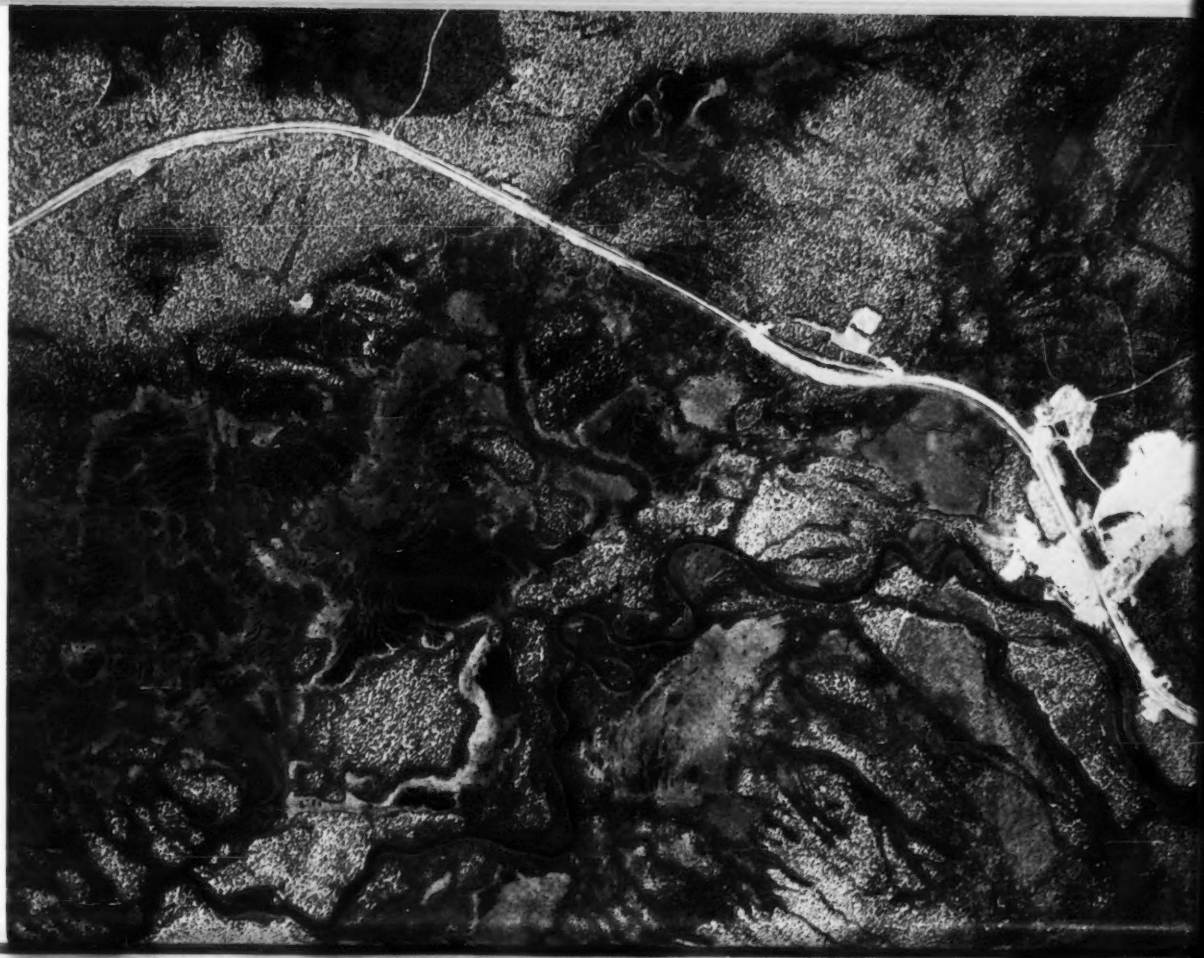
The "Lower Atmosphere," too, was well represented with a meteorological



Models of U.S. Satellite project Vanguard; above, duplicate of U.S.S.R. Sputnik I

On left, General Laclavère, President, International Committee on Antarctic Research, with the Society's President, Lord Nathan, and Lady Nathan

UNESCO I.G.Y. EXHIBITION, WINTER 1958



The Schefferville–Seven Islands iron ore railway, routed around string bogs (about 20 miles north of Seven Islands (see Correspondence "Arctic 'Vegetation arcs'"

National Air Photo Library, Canada: Crown copyright reserved

section. Instruments for measuring and recording temperature, pressure, humidity, wind speed, rainfall and sunlight were displayed. The principles of rainfall and rain-making were explained along with photographs of the various types of cloud formation. From the ceiling hung two radio-sonde balloons, complete with parachutes, radio-transmitters and their meteorological instruments. These balloons, in use throughout the world, provide information vital to weather forecasting by transmitting radio signals back to earth, thus indicating the temperature, pressure and humidity of the air above. Radar-tracking of the balloon can also be used to obtain wind speeds.

The Auroral section provided perhaps the best demonstration in the exhibition. This took the form of a discharge tube, to illustrate the type of discharges that take place in the atmosphere, causing the various auroral phenomena. High voltage, of the order of 10,000 volts, was placed across two electrodes inside a glass tube, which was steadily evacuated, producing streamers, striations and many different coloured discharges. There were many illustrations of the forms these take, and a model showed why these discharges only occur near the earth's magnetic poles. A graph pointed out the correlation between sunspot numbers and auroral activity.

Cosmic rays received much attention and promoted great interest. A permanent cloud chamber was displayed, enabling visitors to see the paths of particles emitted from a radio-active source. Stereoscopic photographs taken of cosmic rays in a Wilson cloud chamber were shown, with a nuclear emulsion plate.

A Geiger counter ticked away when luminous watches and other stronger radio-active sources were brought into its vicinity. A cosmic ray counter telescope was also operating; this consisted of three parallel tubes all in one plane, actuating a counter whenever a cosmic ray passed through all three. Thus it could be seen that the majority of cosmic rays come from above, from outer space, since more were counted when the tubes were aligned vertically than at any other angle.

The remainder of the exhibition was devoted to the I.G.Y. The principal exhibits were two full scale models of the first two Russian Sputniks, the second including the chamber in which the dog Laika was contained. A model of a projected American satellite emitted bleeping noises alongside a model of the three stage Vanguard rocket.

The International World Alert and Warning System was demonstrated on a map of the world equipped with flashing lights to show how scientists are cooperating throughout the world in taking simultaneous observations of solar activity and magnetic perturbations. The techniques of seismology, with the programmes of the I.G.Y. in the Arctic and particularly the Antarctic, concluded the exhibition.

D. PILFOLD

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THE RECORD

CONTRIBUTORS TO THIS ISSUE OF THE JOURNAL

Dr. D. J. Crisp, Director of the Marine Biology Station, University College of North Wales, Bangor, has made a special study of the geographical distribution of shore animals and plants around the British Isles. *Duncan Carse* was leader of the South Georgia Surveys from 1951 to 1957 and made the film "Gateway to the Antarctic." *Professor K. B. Cumberland*, head of the department of geography at the University of Auckland, and founder and former editor of the *New Zealand Geographer*, is also Chairman of the Auckland Regional Planning Authority. *Dr. W. B. Morgan* is a lecturer in geography at University College, Ibadan, Nigeria. *H. St. J. B. Philby*, the distinguished traveller in Arabia and Gold Medallist of the Society, visited the eastern marshes of Iraq during the first world war, and has contributed this article in view of the interest aroused in the region by recent articles and correspondence in the *Journal*. *Dr. K. W. Butzer* is a research associate of the Geographical Institute, University of Bonn. *F. Brian Kennedy* is an assistant lecturer in the department of civil engineering at Queen's Unversity, Belfast, and a member of the Irish Montaineering Club. *Dr. F. G. Hannell*, lecturer in geography at the University of Bristol, has led several of the British Schools Exploring Society's expeditions; *I. Y. Ashwell* teaches geography at Portsmouth Grammar School, and has been an assistant leader and meteorologist of two British Schools Exploring Society's expeditions. *Dr. P. A. Gay* was formerly lecturer in botany and hydrobiological research officer at the University of Khartoum, and is now South-east Regional Officer with the Nature Conservancy, London; *L. Berry* is a lecturer in physical geography, University of Khartoum.

UNIVERSITY NEWS

University of Sheffield

On September 27, the department of geography in the University of Sheffield celebrated its Jubilee. In the afternoon a reunion of about 200 former and present members of the department and a number of distinguished geographers who have been associated with its work, met to hear a Jubilee Address by Professor E. C. Bowen. In this he traced the continuity of thought in the work of Professors Rudmose Brown and D. L. Linton—the first two holders of the Chair—and its application to aspects of the geography of Wales.

In the evening, a Jubilee Dinner was held at Stephenson Hall, attended by 166 persons. The toast of the department was proposed by Professor Dudley Stamp, who appropriately recalled its origins. These, in fact, are of no little interest in that they give concrete evidence of the important role that was played by this Society in the early years of this century, in helping to promote the study of geography in British universities. It so happens that in 1907 the chief speaker at the Annual Dinner of the then very young university was Sir George Goldie, a former administrator of Nigeria; he was also at that time, however, the President of the Society, and the following is an extract from the *Sheffield Daily Telegraph* of 1 November 1907, which is illuminating in regard to the position at that time.

"... Sir George Goldie proposed the toast of the evening: 'The University of Sheffield.' ... Sheffield had endowed the new institution with an admirable and extremely ample organization which showed every sign of vitality and gave every promise of longevity, and in doing this Sheffield had erected a monument which would last as long as Sheffield steel.

"In the midst of all this satisfaction with which the outside world viewed this work, he wished to take advantage of the amiability of that after-dinner hour to venture on a

very slight note of criticism—for which he hoped they would pardon him. When he learned that he was to speak at that dinner he naturally took down 'Whitaker' and turned to the University of Sheffield, and examined with great interest that long list giving the names of all the different studies of the various faculties which made up the curriculum, and to each of which was attached a professor or lecturer. It was a very long, and at first sight a very complete list. It began with mathematics and ended with midwifery—both of which, of course, were highly important—and if he had been taken through that list of studies in his youth he would have been voted a university genius. But the length of the list was not his criticism. His criticism was a different one. Search as they would, they could not find provision in it for the study of geography. . . .

"He did not suppose they had had the occasion or the reasons that he had had as President of the Royal Geographical Society to observe the remarkable change in the attitude of English people towards the study of geography that had taken place during the last twenty-five years, and especially since the South African war, even from its inception so long ago as Majuba. The enormous difficulties and cost of that war were all affected to the disadvantage of this country by geographical ignorance, but the fact remains that since the conclusion of that war there had been a large amount of public attention directed towards the subject of geography. Geography did not mean the position of certain capitals of Europe and the direction of flow of rivers across the continents; it was the study of the whole circumstances of the world in which we live, including productive powers of all its inhabitants, whether animal or vegetable, and its mineral resources, and even the theology and metaphysics of its various human races.

"In two countries abroad the study of geography had been understood to be of almost vital importance to the nation. Those countries were Germany and the United States, where geography had for more than a generation formed a leading part of the curriculum of a liberal education. What came of it? We found that those two nations were overwhelming us in our trade. . . .

"It was not necessary to insist on the importance of a knowledge of geography to the statesman, the diplomatist, the administrator, the civil servant, and the soldier, and he had not time to tell them any of the stories he might tell them, amazing in one sense but deeply pathetic in another, showing how frequently some of all these classes had seriously injured the interests of this country by their geographical ignorance.

"Nor could he develop the incontrovertible fact that geography as now taught was an admirable means of intellectual training, having its own mode of thought and forming an admirable means of culture.

"Sheffield, he believed, was Imperial to the core—and he thought they in Sheffield ought to insist on geography being taught thoroughly on Imperialist grounds, so that the people might thereby assist in the extension of trade.

"After alluding with great appreciation to the admirable map of the world brought out some years ago by Sir Howard Vincent, the forerunner of more elaborate maps that followed, Sir George Goldie said he would like to tell the company what other English Universities were doing in this matter. Birmingham had established both a professor and a lecturer. What Birmingham could do, Sheffield could do. Cambridge was one of the oldest supporters of geography, and its school of geography was under the direction of a reader with three lecturers and in addition to that the University issued a diploma equivalent to honours for geography, and admitted the subject in the curriculum for the Arts degree. Liverpool had a lecturer in geography generally and two lecturers in special departments of the science. London had professors of geography, at both University College and King's College, and admitted geography as an optional subject for matriculation. It was an essential subject for all the degrees of the Faculty of Economic Sciences. Manchester had a lecturer in geography. Oxford was the leader of all, with a large and flourishing school of geography under a reader and at least half-a-dozen lecturers or teachers. Oxford, like Cambridge,

issued a diploma equivalent to honours, and he understood the university was about to admit geography as a subject for a degree. Here were six visible examples, in alphabetical order, of university teaching of geography. If they could only carry on that alphabetical list from Oxford to Sheffield they would have a perfect constellation."

Within a few weeks of the dinner Mr. Edgar Allen—a local industrialist who attended this function and who was deeply interested in education and the new University—offered to the University Council funds for the remuneration of a lecturer in geography, and in 1908 R. N. Rudmose Brown was appointed to this post. From such small beginnings the department grew, and during many years a hard fight for the status of the subject was waged by the late Emeritus Professor Rudmose Brown (who retired in 1947). Under both his and Professor Linton's guidance the department has grown to be one of the largest and best equipped and best housed in the country, and its past students hold posts in a wide variety of fields, the world over. It is appropriate that a gift should have been received from the Royal Geographical Society to commemorate the Jubilee. This, in the form of the fine R.G.S. reproduction of the Catalan World Map handsomely framed and with a suitably illuminated notice now hanging on the walls of the department, will remind for all time students and staff and visitors to the department of the close ties that exist with the Society.

ALICE GARNETT

UNIVERSITY OF LEEDS

The Chair of Geography at Leeds University, recently vacated when Professor R. Peel was appointed to Bristol, has been filled by the appointment of Professor Robert E. Dickinson, PH.D., M.A. Professor Dickinson has been on the staff of Syracuse University, N.Y., since 1947.

UNIVERSITY OF MELBOURNE

John Andrews, Sydney graduate and Cambridge Ph.D. has been appointed to the newly founded geography department at Melbourne University. Professor Andrews' major work has been on settlement geography in Australia and, more recently, on the geography of New Guinea.

UNIVERSITY OF ADELAIDE

Graham Lawton, a Melbourne graduate who later read the Honour School of geography in Oxford, has worked in the United States and New Zealand. He is now promoted from a readership and from headship of the geography department at Adelaide on the creation of a chair of geography there of which Professor Lawton is therefore the first holder.

UNIVERSITY OF BRISBANE

R. Greenwood is a Cambridge graduate who went to the Hydrographic Department of the Admiralty before the war, leaving there at the end of 1947 to take up a lectureship in geography in the University of Otago, New Zealand. From there he was selected to found a department of geography in Brisbane and has now been appointed to the new chair there. His recent work has been concerned mainly with northern Australia.

Editorial note: The Editor hopes to receive further items of University News for publication, in particular from those departments of geography which have not contributed recently to the *Journal*. Such contributions should not be restricted to departmental news, new appointments, and so on, but should include information about new research projects, and about the progress of existing projects.

ROYAL SCOTTISH GEOGRAPHICAL SOCIETY

At their annual meeting in November of last year, the Royal Scottish Geographical Society elected as their president for the next three years the Earl of Wemyss and

March, in succession to Dr. Douglas Allen. Lord Wemyss is also president of the National Trust for Scotland and chairman of the Royal Commission on Ancient Monuments in Scotland. The Scottish Geographical Medal was awarded to Sir Vivian Fuchs, and the Diploma of Fellowship was conferred on Sir James Marshall-Cornwall, retiring President of the R.G.S., on Mr. J. G. Harley and on Miss J. R. Manson.

ORDNANCE SURVEY ANNUAL REPORT

The Annual Report of the Ordnance Survey for 1957–8 is compiled as in previous years; there is a general account of progress in the various departments in the first part, and special points of interest are elaborated in separate sections. A feature of the year's work has been the use of the remarkable "Tellurometer" which provides reliable and accurate measurements of distance by electronic means. It will be remembered that the Tellurometer was demonstrated at one of the Society's meetings, on 24 April 1957, and a description and illustration of it is to be found in the *Journal* for March 1957 (pp. 126–7). The Report also draws attention to a saving of time in drawing maps of up to 27 per cent. by using scribing methods.

MAPS FROM POLAND

The Society received early in 1958 a number of sheets of the Polish General Land Utilization Survey (1 : 1M), and a further small selection of new maps has recently been received from Panstwowe Przedsiebiorstwo, Wydawaictw Kartograficznych, Warszawa. These maps may be divided into three groups. First of all, there are three world maps (1 : 66M) dealing with the distribution of vegetation types, with zoogeography and with minerals; in these colours and symbols are attractively printed. Next we have five regional maps with the collective title 'Mapa Przegladowa Swiata' (World Survey Map Series). The sheets cover Antarctic (1 : 30M), Asia—political (1 : 20M), China and Mongolia (1 : 8·5M), North America—political (1 : 18M) and Poland (1 : 1·5M). In the cases of the first, third and fifth of these sheets, which are layer-coloured, economic products are shown by symbols and a text (in Polish) is printed on the verso. The third group consists of three maps of Poland (1 : 2M) coloured to show relief, geology and soils respectively. In addition to these sheets there is an administrative map of the Polish People's Republic (1 : 1·5M) with a useful index of place-names on the verso. The names in Silesia and eastern Pomerania (Polish-administered territory east of the R. Oder) are, of course, given only in their Polish form. As samples of the latest atlas maps produced in Poland this new material is of interest; the Soviet cartographical style is in evidence with a fine use of colours.

The 'Atlas Swiata' (Warszawa, Panstwowe Przedsiebiorstwo, Wydawaictw Kartograficznych, 1958) is a notable pocket compendium of geographical facts covering the world. It contains much information, tabulated under useful headings. Statistical (economic and population) information is listed under separate countries; there is a section of maps (chiefly political) and a gazetteer of place-names. Although there is the obvious language difficulty for users who do not read Polish this atlas is of particular value because it contains so much which is otherwise scattered in atlases and reference books. Tables are included giving the areas of sub-continental land masses, islands, oceans, seas and gulfs (with mean and maximum depths), lakes (with maximum depths), lengths of rivers, heights of waterfalls, heights of mountains (including volcanoes, with date of last eruption), areas of deserts, populations of cities and conurbations (with dates).

The bibliography at the end suggests that a wide selection of the standard reference annuals have been consulted in compiling the information. The text is unfortunately marred by the fact that the inking is inadequate on a surprisingly large number of pages. In the binding, flexibility and durability are well combined by the use of

plastic for the cover, although lettering has suffered: there is no lettering on the spine. But it should be said that this reference atlas is for the desk rather than the library shelf. E. J. HUDDY

POPULATION OF SUDAN: MAPS

We have received from Mr. H. R. J. Davies, of the Department of Geography, University of Khartoum, five maps of Sudan compiled by him and Mrs. G. Davies for the Department of Statistics. These illustrate some of the results of the First Population Census of Sudan, 1955–6. The maps, on the scale of 1 : 8m., are based upon the Census areas. The most elaborate map is "Tribes in Sudan," which shows by colour and proportionate divided circles the distribution of the eleven main ethnic categories of the Census where they numbered more than 5 per cent. of the population of any Census area: within each major group individual tribes have been represented when they reached 15 per cent. of the population of the group. A key to Census area codes is provided. The other maps show West Africans in Sudan, languages, Arabic speakers, and population density. It should be noted that 'The population of the Sudan: report on the Sixth annual conference, Philosophical Society of Sudan,' Khartoum, 1958, includes maps on the same scale of the Census areas and of land use, compiled by Professor J. H. G. Lebon. The Report contains a note on these and other maps displayed at the Conference.

EXPLORATION IN THE REPUBLIC OF HONDURAS

A letter has been received recently from Mr. D. K. Truscott, a Fellow of the Geological Society, who has been working in the Republic of Honduras as a mining engineer. Mr. Truscott draws attention to the possibilities of an expedition to the country in the vicinity of the Patuca and Platna rivers, an area virtually unknown, and of which the geology, flora, fauna and archaeology merit close study. Travel would have to be on foot and canoe owing to the absence of trails. The area is sparsely populated by remnants of the Musquita tribe, and game and fish are plentiful.

EXPEDITIONS IN THE FIELD DURING 1958

Reports have been submitted to the Research Committee from expeditions to which financial and other aid was announced in the *Journal* for June 1958. Unless otherwise stated, the expeditions worked during the Long Vacation of 1958 and the full reports may be seen in the Society's Library.

1. *Imperial College Icelandic Expedition.*—Nine members under the leadership of G. P. L. Walker spent two to three months in Iceland surveying and doing geological work.

2. *Cambridge Spitsbergen Expedition.*—Two parties led by P. F. Friend (Party A) and D. J. Gobbett (Party B) were based on Billefjorden, and topographical and geological work was carried out.

3. *Cambridge West Greenland Glaciological Expedition.*—A glaciological expedition of six men from Cambridge led by T. A. Henry spent three months in Greenland in the summer of 1958 studying the formation of wave ogives on Lyngbrae, a glacier flowing from the Sukkertoppen ice cap to the Søndre Strømfjord.

4. *Birmingham and Exeter Universities joint Spitsbergen Expedition.*—The expedition (leader, P. A. Garrett, Birmingham; deputy leader, D. L. Dineley, Exeter) had as its main task the study of the Carboniferous and Permian formations of Ekmanfjord, central Vestspitsbergen, linking previous work in the St. Jonsfjord-Trygghamna area with that published concerning the Billefjord area.

5. *Oxford University Tanganyika Expedition.*—A preliminary report describes the work of an Oxford University party, led by Mr. Peter Simkin and assisted by the Tanganyika government; a preliminary scientific survey of the Kungwe-Mahali Mountains on the eastern shore of Lake Tanganyika was made.

6. *University of Durham Exploration Society: Arctic Norway.*—An expedition to

the Svartisen area of Arctic Norway led by P. F. Williams carried out work on glaciology, geology, survey, zoology, botany and geophysics.

7. *Makerere College Ruwenzori Expedition.*—This expedition was engaged on research on certain Ruwenzori glaciers as part of the work of the I.G.Y. The expedition followed up a reconnaissance of the previous year, undertaken by F. P. Henderson (leader and geologist), J. Whittow (glaciologist) and A. Shepherd (surveyor) who were joined in June 1958 by J. E. Goldthorpe (stores and transport officer) and W. H. G. Dickins (geographer). The expedition was brought to a tragic end by the death of W. H. G. Dickins on 21 June 1958. A brief account of this, and of the work accomplished, may be read in the *Journal* for December 1958 (pp. 580–1).

Some reports have also been received from expeditions to which instruments were lent, and these may be summarized as follows:

1. *Oxford Chitral Expedition.*—An attempt was made to climb Saraghrar (24,110 feet), but was abandoned after an accident to P. S. Nelson which resulted in his death.

2. *Cambridge Atacama Desert Expedition.*—This expedition to the Atacama district of northern Chile and adjacent Bolivia was led by C. Vita-Finzi of St. John's College. Its aims were to elucidate the area's climatic history since the Pleistocene period, and to find proof of Pluvial periods; and to study the archaeology of the area, and the relation of dwelling and camping sites to present and past climatic and vegetational conditions.

3. *Minapin-Karakoram Expedition.*—A small expedition led by Ted Warr, on which he and Dr. Chris Hoyte lost their lives in attempting to reach the summit of Minapin (23,800 feet).

4. *Sherborne Kulu-Spiti Expedition.*—A brief report on survey in the Spiti valley has been received from J. P. O'F. Lynam.

The condolences of the Council of the Society were sent to the mountaineering expeditions which suffered these tragic losses in the course of the summer.

Certain expeditions not assisted financially by the Society have also submitted reports.

1. *Wye College Icelandic Expedition.*—This expedition, approved by the Society and led by Peter England, has as its object to collect botanical and geological specimens and to correlate the plants with the soils in an area in the north-east of Iceland.

2. *Westminster Hospital Scientific Expedition to Belgian Congo.*—This expedition, also approved, led by P. M. Aichroth and still in the field, is sending regular progress reports.

3. *University of Durham Exploration Society.*—As usual, Durham has had a number of expeditions in the field. Reports have been received of ventures in Newfoundland, Mauranger (Norway) and Glen Affric. Also received is a detailed report of the women's expedition to Solheimjökull (Iceland) in 1955. The expedition, led by Joan Pattison, King's College, had as its aims: to study the biological colonization of the ground recently freed from ice; to make meteorological observations; to map the snout of the Solheimajökull glacier, in order to record glacial retreat; to make a photographic record of the countryside around the glacier. This report is fully illustrated with photographs and diagrams, and contains, in a pocket of the cover, maps, graphs and diagrams to illustrate the botany, zoology, meteorology and surveying sections of the report.

GEOGRAPHICAL SCIENCES IN THE U.S.S.R.

During his visit to this country in the summer of 1958, when he addressed the Society, the Russian geographer Academician I. P. Gerasimov delivered a lecture at Birkbeck College, University of London. The address, delivered on May 14, dealt with the present state of the geographical sciences in the U.S.S.R. and their likely

development. Space does not allow the reproduction of Academician Gerasimov's lecture in full, but the following extract may be of interest to Fellows. It will be remembered that the Academician's address to the Society on questions of land use, delivered on May 12, was published in the *Journal* for December 1958. Academician Gerasimov's lecture at Birkbeck was based on the report of the XVIIIth International Geographical Congress (Rio de Janeiro, 1956). The proceedings of the All-Union Congress of the U.S.S.R. Geographical Society (Moscow, 1955) served as the basis of this report; all its principal statements took account of the detailed resolutions of the Congress as adopted by the majority of its members.

Academician Gerasimov's review of the geographical sciences in the U.S.S.R. opened with an enumeration of the most important problems facing Soviet geographers, problems stated some three years ago in the Resolutions of the All-Union Congress of the Geographical Society of the U.S.S.R. These may be summarized as follows:—

1. The further development of comprehensive geographical expeditions, and of cartographic work for revealing new natural resources and for developing production in all regions; such development of resources to be carried out under economic control, and in conjunction with new construction schemes. Of special importance is geographical field-work in the eastern regions of the Soviet Union (Siberia and the Far East).

2. Registration, economic assessment and development of methods for using natural resources, and their protection from natural destruction. Registration must include: (i) a general review of available data on the natural resources of the country as a whole and on its separate regions, and (ii) an appraisal of the present stage of their use.

3. Intensive development of such scientific research as is connected with the harnessing and use of natural resources for the benefit of the Socialist economy. Schemes for transforming water and thermal regimes in the developed territories are most important, as is the tackling of harmful natural processes—*e.g.* erosion, drought, flood, etc.

4. Study of the laws of geographical distribution of social production, of the territorial (geographical) division of labour and of the formation of economic regions; economic assessment of land conditions and resources; practice and methodology of economic-geographical division into districts, and the working-out of regional-complex economic problems; study of the geography of population.

Among points made by the lecturer, the following will be of interest to British geographers.

"The principal role in the development of geographical sciences in the U.S.S.R. and the chief responsibility for solving the problems facing them, belong to the leading scientific research institutes of a geographical character. We may name among them the Geographical Institute, Academy of Sciences of the U.S.S.R.; geographical scientific institutions attached to the Academies of Sciences of Union republics (Georgia, Azerbaijan, Armenia, Latvia, Lithuania, Kazakhstan, etc.) and to the departments of the Academy of Sciences of the U.S.S.R. (Komi, Moldavian, Ural, West Siberian, East Siberian, etc.); scientific Institutes of the Central Board of the Hydrometeorological Service (Central Geophysical Observatory, Hydrological Institute, Central Institute of Forecasting, etc.), Central Board of Geodesy and Cartography (Central Scientific-Research Institute of Geodesy, Cartography and Aerophotography) and Central Board of Northern Sea Route (Arctic Institute, etc.); geographical chairs and departments of Universities (in the first place in Moscow, Leningrad, Kiev, etc.) and of educational institutes.

Next to these leading, and purely geographical, scientific institutions in the U.S.S.R., are a number of geological, geophysical, biological and economic institutions (for example, Institutes corresponding to Academies)—where questions of a

special geographical character are being worked out (for example, geomorphology, soil geography, plant and animal geography, economic geography, etc.). A great number of Soviet scientific geographical research institutes base their work on a still larger number of scientific-practical institutions—planning organs of All-Union, republican and local significance—on the system of hydrometeorological and other stations, various designing and prospecting organizations, etc.

The total number of Soviet scientific workers and specialists in the geographical field is considerable. It is difficult to determine their precise number because of some uncertainty of criteria for differentiating scientific specialisms, and between research and scientific-practical works, or between researchers and teachers. It may be stated, however, that the Geographical Society of the U.S.S.R. has now 7000 members, mostly research geographers. Because of many scientific and scientific-practical institutions of a geographical kind the coordination of scientific research is particularly important in the U.S.S.R. The main responsibility for this coordination lies with the Academy of Sciences of the U.S.S.R., and in the geographical field this coordination is carried out by the Geographical Institute, by the Council for the Study of Productive Forces, and by other leading scientific geographical institutions. The Council for the Study of Productive Forces is a special organ of the Praesidium of the Academy of Sciences of the U.S.S.R.; it organizes and coordinates the work of the most important geographical expeditions. Soviet geography has great experience in carrying out such expeditions; now as formerly they are organized for the thorough geographical study of some one part of the country and with a view to elaborating plans for the controlling of natural resources and for the development of productive forces. Expeditions launched by the Academy of Sciences of the U.S.S.R. have included the following:—Caucasian, Ural, Kazakhstan, Turkmenian, Yakutian, Krasnoyarsk, Buryat-Mongolian, Tuvinian, Chitan and Far Eastern. Recently, expeditions organized in the U.S.S.R. have gone beyond the limits of the country; for example, Soviet geographers are carrying out extensive scientific work in Antarctica and in the adjacent seas as part of the I.G.Y. programme. Members of different scientific institutes of the Academy of Sciences of the U.S.S.R., of its departments ('filials') and of the Academy of Science of Union Republics play a great part in these expeditions; very often, too, meetings are called with other scientific institutions (for example, the Hydrometeorological Service, Central Board of Geodesy and Cartography, etc.), as well as the geographical chairs and departments of universities. The Scientific Institutions of the Central Board of the Hydrometeorological Service (Central Geophysical Observatory, Hydrological Institute, Central Institute of Forecasting, etc.) together with the Geographical Institute, Academy of Sciences of the U.S.S.R., and other scientific institutions organize, coordinate and carry out scientific research work in the study of hydro-climatic conditions of the country and the investigations of natural phenomena. Particular importance is attached to the study of the water-thermal regime of the land surface, to its role in the dynamics of natural processes, to its geographical differences, and to methods of altering them for practical purposes.

The scientific institutions of the Academy of Sciences of the U.S.S.R. (the Council of the Study of Productive Forces, the Geographical Institute, and others), the geographical chairs and departments of universities, in close contact with the planning institutions, are all undertaking work on the natural and economic division into districts of the territory, as well as of the separate regions, of the U.S.S.R. This work will provide the scientific basis for the thorough registration of natural conditions and resources throughout the country, for the elaboration of plans for rational geographical distribution of national economy, and for the development of productive forces in the different regions. The Geographical Institute of the Academy of Sciences of the U.S.S.R., together with the special Geographical Publishing House and other scientific institutions, organize in the U.S.S.R. extensive work on the compiling of physio- and economic-geographical monographs. These books contain a complex

geographical synthesis of the large natural or economic regions of the U.S.S.R. and of foreign countries, and are based mostly on the scientific analysis of geographical materials previously collected. Similar scientific and publishing work on the compiling and publishing of newly reviewed geographical maps and atlases is being carried out by the institutes of the Academy of Sciences of the U.S.S.R. in cooperation with the institutions of the Central Board of Geodesy and Cartography."

Russian participation in international geographical meetings is of great importance and Academician Gerasimov concludes his report on work in the U.S.S.R. by stating that: "Out of eighteen International Geographical Congresses the Russian (Soviet) geographers have taken an active part in fifteen. Thus, only the three Congresses before this last one have been missed. At the XVIIIth Geographical Congress, the Academy of Sciences of the U.S.S.R. became a member of the I.G.U. and Soviet geographers have entered into the permanent Commissions which, through international collaboration, are working on certain important scientific problems of geography.

"In 1960 the XIXth International Geographical Congress takes place in Stockholm, and the U.S.S.R. has begun preparatory work for it. This may be seen in the activities of the Soviet sections of permanent Commissions of the International Geographical Union (Commissions on the Compilation of National Atlases, on Medical Geography, on Periglacial Phenomena, on the Study of Arid Regions, and others) and in a series of special scientific conferences for the joint preparation of important scientific reports. Among them are planned conferences on national geographical atlases; on methodological questions of natural and economic division into districts, on the problem of thermal and water regime of the land surface; on glacial and palaeoglaciological problems."

Academician Gerasimov concludes his review with the following observations.

"It would seem desirable to establish good contact in this scientific preparation for the XIXth International Congress with English geographers and with geographers of other countries. There exist many common scientific problems of theoretical and practical importance for the geographers of our countries. Their consideration jointly, the exchange of scientific achievements and of accumulated methodical experience, and general discussions are important ways in which such problems may be worked out. Therefore the thorough strengthening and developing of our scientific contacts with the aid of various practical methods is an urgent necessity for both countries. It is necessary to use for this purpose all the favourable factors and to consider the common participation in the work of the international scientific organizations as one of the means for further *rapprochement* and advance in the field of geographical sciences."

SOVIET SERIALS IN THE SOCIETY'S LIBRARY

BULLETIN (IZVESTIYA) ACADEMY OF SCIENCES OF THE U.S.S.R. GEOGRAPHICAL SERIES, 1958, No. 4 (July–August). The current position with regard to Dokuchayev's theory on the zoning of soils and L. I. Prasolov's ideas on soil regions and their importance with regard to regional geography, by I. P. Gerasimov. Problems connected with the circulation of waters in the oceans, by M. N. Koshlyakov. Pacific Ocean currents, by A. M. Muromtsev. Causes of the monsoons in Southern Asia, by G. N. Vitvitskiy. The major economic regions of Brazil, by V. V. Pokshishevskiy. The formation of platform structure in the quaternary era, by G. V. Obedientova. Geographical features peculiar to small rivers in the Patom uplands, by A. M. Grin. Sand formations as affected by winds in the Pricaspian lowlands, by Yu. L. Rauner. Coast accumulation caused by reed swamps and its effect on the rise in sea level, by V. I. Lymarev. Fluctuations in the level of Lake Balkhash indicated by geomorphological and historical evidence, by K. V. Kurdyukov. Natural and economic resources of the southernmost part of the Krasnoyarsk district and means of their exploitation, by

D. A. Golovkin. The study of thermal balance on the surface of the earth, by M. I. Budyko. Memorable dates in the history of geographical science, by V. I. Grekov and others.

SAME SERIES, No. 5 (September–October). Structural features of relief in the U.S.S.R. and their origin, by I. P. Gerasimov. Forecasts of river run-off, by D. A. Drogaytsev. Zonality of protein content in wheat, by E. A. Dorogonevskaya. Geomorphology and glacial history of the north-western coast of Shelikhov Bay, by V. E. Dibrov. History of the Lena basin, by N. C. Chebotareva and N. P. Kuprina. Recent tectonic developments in the "Shcheki" region of the Podkamennaya Tunguska river, by G. I. Amurskiy. Quaternary volcanoes in Mongolia, by Yu. S. Zhelubovskiy. Peculiarities of the structure of the lower Anga and Buguldeyka river basins (western Pribaikal) and the movements of their river beds, by L. V. Zorin. Relics of former permafrost in the Pavlodar region, by M. E. Gorodetskaya. Thermal balance of the periodic water changes in the U.S.S.R., by S. I. Zhakov. Some results of investigations into thermal balance in deciduous forests, by Yu. I. Rauner.

BULLETIN (IZVESTIYA) ALL-UNION GEOGRAPHICAL SOCIETY, Vol. 90 (1958), No. 4 (July–August). Two special aspects of the geography of east Antarctica, by K. K. Markov. Hydrobiological peculiarities of stationary polynia, by V. N. Kupetskiy. Toponymics of eastern Siberia, by G. M. Vasilevich. Three weeks in Yugoslavia, by S. B. Kalesnik. The "zonal conception" of K. I. Fatkin, by A. G. Isachenko. F. Ya. Kirin's paper on the subject of economic geography, by L. E. Epshteyn. Heinrich Ficker (on the anniversary of his death), by S. P. Khromov.

SAME SERIES, No. 5 (September–October). Academician Andrey Aleksandrovich Grigor'ev—on his 75th birthday [anonymous]. The part played by A. A. Grigor'ev in solving the problems of physico-geographical regions, by V. I. Prokayev. The effectiveness of water conserving forest belts along rivers and the problem of their exploitation, by M. I. L'vovich. The first Russian expedition to the Okhotsk sea coast in the 17th century, by N. N. Stepanov. The formation of economic regions in India, by L. I. Bonifat'eva. Pavel Ivanovich Koloskov (on his 70th birthday and after 50 years of scientific activity), M. I. Mel'. Obituary of Vladimir Vikent'evich Batyr, by V. A. Duglav. Obituary of Vladimir Nikolayevich Shnitnikov (1873–1957), by A. I. Dzens-Litovskiy.

N. D. JENNINGS

BRITISH ASSOCIATION: YORK MEETING, 1959

Lord Rennell was appointed General Treasurer of the British Association at the Glasgow meeting, an account of which was given in the *Journal* for December 1958 (pp. 576–8). He would like to remind Fellows that the next meeting of the British Association will be held in York from September 2 to September 9. Fellows wishing to attend can become temporary members for the meeting only. They will be equally welcome as permanent members or life members of the Association. No scientific qualifications are required nor is it necessary to have a proposer or seconder. Application for membership can be made on arrival at York or, prior to that date, to the Secretary at the office of the British Association, 18, Adam Street, London W.C.2. One of the principal objectives of the meeting is to bring scientists of different disciplines together and also to provide a common meeting ground between scientists of all disciplines and laymen who are interested in scientific matters.

Particulars of the programme can in due course be obtained from the British Association office. The meetings give opportunities for geographers to attend and learn of work that is being done in all the other Sections of the British Association and also to participate in some of the many excursions which are organized by the Sections as well as in the general excursions.

NOTES

A reprint has been received in the Library of an article by Professor Leslie H. Palmier, Associate Professor of Asian Studies in the Victoria University of Wellington, New Zealand. The article, entitled CONSTITUTIONS AND GEOGRAPHY IN INDONESIA, is from WESTERN PACIFIC: STUDIES OF MAN AND ENVIRONMENT IN THE WESTERN PACIFIC (Collected papers produced by the Department of Geography, Victoria University of Wellington, in collaboration with the New Zealand Geographical Society, Wellington Branch, 1958, pp. 13–25). Professor Palmier's article discusses the relationship between methods of food-crops production and local social structures in the various regions of Indonesia. The main divisions are the *sawah*, or paddy, area of Java, the *ladang* areas of Sumatra, and the *sago* of east Indonesia. *Sawah* production provided a surplus and encouraged a centralized social organization which for long gave Java dominance over the other areas. Growth of population has turned Java into a deficit area, dependent for survival on the surpluses now produced by the other islands. Political representation, however, is related only to population, not to regions. Hence, the "surplus" areas are controlled by the most populous area, Java, which is economically dependent on them. The situation gives rise to great tension; no solution is yet in sight.

* * *

MCGILL UNIVERSITY, MONTREAL, is offering five graduate assistantships per annum, for post-graduate research, tenable at the McGill Sub-Arctic Research Laboratory. The Laboratory is situated at Schefferville (Knob Lake), a mining town of some 3000 inhabitants in central Labrador-Ungava. The positions carry a stipend of $3880 under an arrangement with the Department of Transport, Canada, for whom the students act as meteorological observers. Students interested in conducting research into sub-arctic and arctic problems should write for all information to Dr. J. D. Ives, Field Director, McGill Sub-Arctic Research Laboratory, P.O. Box 790, Schefferville, P.Q. Canada.

* * *

The SCOTTISH FIELD STUDIES ASSOCIATION has issued its programme for 1959, and a full list of courses may be obtained from the Association, c/o The Department of Botany, The University, Glasgow, W.2. New courses to be held for the first time in 1949 include one on Marine Biology (May 16–23), one on Insect Ecology (June 20–27) and also studies on crofting in the Isle of Lewis. A certain number of bursaries are available from Carnegie United Kingdom Trust funds to enable members of scientific societies to attend these courses; applications to be made to the Scottish Field Studies Association.

OBITUARY

SIR HUBERT WILKINS, M.C.

George Hubert Wilkins was born on 31 October 1888 at Mount Bryan East, 100 miles from Adelaide. His father was a South Australian and, at the time of his birth, his mother was nearly 50 and his father was 52; he was 13th in the family. To few has it been given to achieve throughout their lifetime such a measure of fruitful activity in every field of exploration; by land, in the air, in the sea and under the sea. Hubert Wilkins was educated in the School of Mines at Adelaide, and stowed away in a ship at the age of 20 as prelude to four years of wandering through Europe and America, during which he learned to fly an aeroplane. In 1913, having joined Vilhjalmur Stefansson's expedition to the Canadian Arctic, he lost his ship *Karluk* off Point Barrow and proceeded, in company with five others, to explore and live off the country for three years. Stefansson described Wilkins as "easily my best man." Returning to find his country at war, Wilkins travelled to Europe and joined the Royal Australian Air Force; he was twice mentioned in despatches and won the M.C. with bar.

From 1920–2, Wilkins served in Shackleton's Antarctic expeditions as naturalist. In 1923, on behalf of the British Museum, he led an extremely successful expedition to north-eastern Australia where he spent two and a half years studying the aborigines and the fauna. He proved a most capable leader and, unlike many other explorers, succeeded in operating within his budget.

Ever since he had learned to fly, Wilkins had wanted to use an aeroplane for exploration and in 1926 he took one, and a co-pilot Carl Ben Eielson, to Point Barrow, where he felt that a meteorological station should be established. They spent two years in this area, considerably hampered by the undeveloped art of Arctic flying at that time, suffering various crashes and on one occasion having to walk home 100 miles over the ice; this took fourteen days and they only survived because of Wilkins' previous hard training. With such a background of experience, in April 1928 he decided to attempt the prodigious flight from Point Barrow to Spitsbergen. In a Lockheed Vega single-engined ski-plane he and Eielson set out to the north coast of Ellesmere Land and then skirted northern Greenland on a 2200 mile non-stop flight to Spitsbergen. Their navigational instruments consisted of a magnetic compass and a bubble-sextant, with which to take shots of the sun. Hitherto only Amundsen's airship, the *Norge*, had completed a transit of the Polar Basin, and the task of two men in an aeroplane was infinitely more difficult. They changed course twenty-one times, but their method proved successful and after 20 hours 20 minutes they landed on Deadman's Island, just off Spitsbergen. Their only disappointment was that no new land had been sighted on their voyage. For this magnificent flight, Wilkins received his knighthood and was also honoured by the Society with the Patron's Medal "for his many years systematic work in Polar regions, culminating in his remarkable flight from Point Barrow to Spitsbergen."

Without resting on his laurels, Wilkins immediately organized an expedition to the Antarctic and arrived there in November of the same year, again with an aeroplane and again with his co-pilot Eielson. From Deception Island they carried out the first flight ever made in Antarctica and flew south to 72 degrees before returning. They reported that, contrary to previous belief (and now an established fact), Graham Land was not a continuous land mass forming a peninsula, but two large islands separated by ice-filled channels. They had been misled by glaciated country which from a height and a distance had appeared like a sheet of broken sea ice, a mistake which can easily be made from an aeroplane, however much experience one may have.

Returning to Deception Island in 1929, Wilkins made several more flights, one of

which rightly proved that Charcot Land was an island. He would have liked to have made a Trans-Antarctic flight to the Ross Sea, similar to his Trans-Arctic one, but he could not find a satisfactory starting point for his overladen plane. He also was an advocate of meteorological stations in the Antarctic to form a chain for the prediction of Southern Hemisphere weather.

In 1931, he secured the loan of the U.S. Naval submarine 012 which he named *Nautilus*, and planned to set off in her from Spitsbergen to reach the Pole under the ice. In August he left Long Year, Spitsbergen, in this craft, but ran into severe weather which damaged the hydroplanes, making diving almost impossible. However, he reached 82 degrees 15 minutes before returning and obtained a great deal of valuable oceanographic data. Subsequently he planned to build a special submarine in England, but this never came off. In 1933, Wilkins acted as air adviser to Lincoln Ellsworth in the base ship *Wyatt Earp* for Ellsworth's three attempts to fly across Antarctica in 1933, 1934 and (successfully) 1935. Having been consultant to the U.S. Army on Military Planning from 1942–52, Wilkins became Geographer to the Research and Development Command, Department of Defence, a post he held until his death at Framingham, Mass., on 1 December 1958. He had married in 1929, Suzanne Bennett, who survives him.

George Hubert Wilkins's challenge was the challenge of the pioneer: "I give my Idea, I contribute my Endeavour; nothing more and nothing less. Results and success, if they come my way, may bring joy, but on my horizon they signify nothing." Father of flying in the Arctic and Antarctic, pioneer of submarine Arctic exploration, Wilkins, in all his varied work, scored incidentally far more success than failure. His mistake in thinking Graham Land was not a peninsula did not lessen in any way his achievement in being the first man ever to fly in Antarctica, nor did his failure to go under the ice detract from his foresight in fathering the "Idea," which allowed him to witness a later nuclear-powered *Nautilus* succeed. In the words of Sir James Wordie, who knew Wilkins well, he was a man with sparkle and, above all, a loyal companion.

JOHN GRIERSON

CORRESPONDENCE

TRAINING OF CARTOGRAPHERS

Trends in modern cartography are two-fold: on the one hand the introduction of new techniques and materials and on the other the increasing need to meet the requirements of specialist users and to work in close liaison with many national and international organizations. Letters in the *Journal*, **123**, 4 (1957), p. 562, and **124**, 3 (1958), p. 423, suggest that the graduate geographer should be concerned with a very limited aspect of the former, largely technical, trend instead of the latter.

In cartographic circles "compilation" defines the process of selecting and plotting detail and positioning names and symbols in order to create a clear map with a density of detail appropriate to the scale. The draughtsman who builds up the compilation must also be able to draw it for reproduction in accordance with a rigid specification. All this work requires technical skill and experience but today, when most new mapping is based on air photography, "the more exacting work" carried out by the cartographic draughtsman is probably that of interpreting the detail on air photographs. Here, the graduate specialist concerned with land use, forestry or geology fulfils the valuable role of consultant. Furthermore, the cartographic draughtsman is required to plot maps using photogrammetric techniques.

Senior cartographic draughtsmen need and, indeed, do possess vastly wider knowledge and experience but this is largely technical and can only be obtained through years of production experience supplemented by courses concerned with the materials

and instruments available for plotting and drawing, the developments in photo-mechanical techniques and the limitations imposed by photo-litho methods of printing. Effective training in such subjects is hardly appropriate to a degree course in geography but much time and effort would be saved if cartography lecturers would emphasize to their students the need to seek technical advice on all these matters at the very outset of any proposal involving the printing of maps.

Geography graduates employed in a cartographic establishment are required to evaluate existing map material, provide guidance for its use in compilation, assess and compute survey data, establish liaison with other mapping organizations and place-names committees and help to coordinate the mapping requirements of governments, technicians and academic specialists. It would be as uneconomic to employ graduates on the lengthy day to day process of compilation as it would be to employ senior cartographic draughtsmen, and if increased university education were in fact to force such unsuitable employment of graduates there would surely need to be some re-thinking on education policy.

I reiterate that "compilation is and should continue to be done by cartographic draughtsmen who need experience of what detail can be shown at what scale and the ability to plot and fairdraw the map."

W. D. C. WIGGINS

Directorate of Overseas Surveys,
Kingston Road,
Tolworth, Surbiton,
Surrey
10 *October* 1958

Dr. Maling replies:

> *The science or art of map compilation lies, first, in valuing the accuracy and usefulness of all the available material; secondly, in interpreting it and deciding how to use it; and finally, in fitting it into a previously decided frame at the required scale.*—W.O. Field Survey Pamphlet No. 3.—1941.

It is clear that some of the differences which have been aired in this correspondence arise from two different uses of the word "compilation." Mr. Wiggins has given a definition in the second paragraph of his letter which corresponds to only one aspect of the work as defined above. This usage is equivalent to the word "generalization" as used by Deetz and other writers. Later, however, Mr. Wiggins lists some of the other activities which are necessary to map production and which can be attributed to the work of "compilation" following the definition which I have quoted.

The emphasis which must be placed upon the three aspects of "compilation" varies, of course, with the sort of maps which have to be made. At one extreme there is the comparatively straightforward and almost purely technical job of preparing (say) one of the sheets of the new 1 : 250,000 Ordnance Survey series. At the other end of the scale were the extremely difficult problems of reconciliation of conflicting cartographic evidence which arose during the preparation of the I.M.W. sheets of Hispanic America by the staff of the American Geographical Society. Somewhere between these extremes lie the majority of problems of evaluation and interpretation which arise in the preparation of small-scale topographical maps for any sort of civil or military purpose. The especial importance of these aspects in the production of military maps was examined by me in an earlier letter (*Geogr. J.*, **124**, 3 (1958), pp. 423–4).

However, this controversy cannot be resolved only as a disagreement in terminology, for we hold certain views which are less easily reconciled.

It seems to me that much of the selection of detail for small-scale mapping, which is regarded by Mr. Wiggins as the proper work of the cartographic draughtsman, is not only a technical problem but also an exercise in applied regional geography. The cartographer must know how to select, generalize and position names so that the map

is technically and aesthetically satisfactory. He must also make a sensible interpretation on the map of the combination of physical and cultural elements which comprise the particular region without departing from objective accuracy. As in the purely technical aspects of draughting, this demands an answer to the question of what detail should be shown, what should be left out. It is the subjective problem which is fundamental to the whole business of map-making whether the detail is surveyed on the ground or plotted from aerial photographs. The full answer cannot be given in terms of a rigid specification. No small-scale series which covers any large area of the earth can have a specification which is so complete that every aspect of the selection of detail can be carried out by rote. More properly this selection should be made through an intelligent interpretation of the regional geography within the guiding framework of the specification. The cartographer can only select what detail is appropriate if he has some idea of how the various elements of drainage, land forms, vegetation, land use, settlement and communications fit together and how they vary within the limits of the map. He must have more than a superficial knowledge of the regional geography of an area if he is going to understand what he should show, what he should omit.

There is, in fact, a great deal of truth in the opinion of Raisz that "A cartographer is a geographer who can draw a map besides." Whether this condition can be better achieved by teaching geography to cartographers or by teaching cartography to geographers is a question which would be best answered by the French, Norwegians, Germans or Russians. In this country we have so far done neither. D. H. MALING

Department of Geography,
University College of Swansea
22 December 1958

Mr. Wiggins writes further:

Since writing the above I have seen Mr. Klawe's letter (*Geogr. J.* **124** (1958) p. 587).

The correspondence between Dr. Maling and myself has been confined to the role of geography graduates in the specific task of map compilation within map production.

Mr. Klawe has missed this point and by so doing implies that all the graduate members of the staff of the Institut Géographique National are engaged upon the particular task of map compilation and that they and they only compiled the Relief Form Atlas. The ingénieurs-géographes, in fact, include field surveyors, computers, etc. On the total staff of this Directorate over 11 per cent. are graduates, a higher proportion than that quoted for the I.G.N. More than half our graduates are engaged on field survey (they are given a year's post-graduate course before proceeding to the field) while the others are employed in the Computing, Forest and Land Use and Records Sections.

But none of this affects the issue that the actual map compilation should be done by cartographic draughtsmen who are specially trained for and experienced in the task. Newly graduated geographers and students will be misled if their mentors do not take the trouble to find out exactly what they are advocating in the way of careers.

Throughout the correspondence, Dr. Maling has generalized from the academic point of view and I have particularized from the practical point of view of one engaged on map production. In the business of manufacturing motor cars the fitter is not taught upholstery nor *vice versa*. So, too, map production contains a number of operations. I shall remain unimpressed by Dr. Maling's arguments until he can show me from practical experience that a geographer who has been taught to draw can compile better maps as his life's work and at no greater cost, than an experienced cartographic draughtsman. W. D. C. WIGGINS

Directorate of Overseas Surveys,
Tolworth
1 *January* 1959

THE MARSHES OF SOUTHERN IRAQ

The object of this letter is to commend Mr. C. J. Edmonds' review of Mr. Gavin Maxwell's book on the marshes of southern Iraq, of which I have unfortunately not yet been able to procure a copy. Without any question whatever Thesiger is the master of all marsh lore and the outstanding authority on all matters concerning the Ma'dan: having spent some fifteen months among them between 1950 and 1954, though he has written remarkably little on the subject. He did well to have a professional writer with him on the occasion which produced 'A reed shaken by the wind,' evidently an excellent account of their joint adventure. Edmonds does equally well in quashing the author's claim "that the journey . . . was through an almost unexplored land about which only two other Europeans know anything very much." Thesiger who, as Edmonds points out, "has made no such claim," is obviously one of them. Who was the other? Perhaps S. E. Hedgcock, but surely his wife must be included with him, and that makes three. So perhaps he was thinking of C. E. Corry, the policeman-novelist of the Muntafiq. The trouble with all these people, including A. T. Wilson whose 'South-west Persia' has no map at all, is that they have not made, or published, anything that one can seriously call a map of the area. The map appearing with Thesiger's article in the *Journal* of September 1954 leaves much to be desired; and I have not been able to consult the works of Buxton, Dowson, Lady Drower and van Ess, to which Edmonds refers as containing incidental information on these marshes. The G.S.G.S. Million sheet for Basra dismisses the 'Amara marshes as "unsurveyed," without a single place-name in 1945! The 1942 (1 : 253,440) map referred to by Edmonds does not seem to help much with the eastern marshes, though I have not seen it myself. The G.S.G.S. (No. 2563) Million map of 1907 (corrected to 1916) shows the Turco-Persian boundary, and gives some information about places on the Persian side (Huwaiza, Busaitin, Thaila and Umm Chir, etc.) but certainly suggests that the marshes proper were unexplored up to 1916. A Turkish map of 1909 does not help at all beyond the tails of the Tigris left bank canals. But the most interesting of all the maps covering the marsh area is an undated one "for official use only," which appears to have been based on an aerial photographic survey, subsequently worked on by surveyors (not named and probably Indian) of the I.E.F. "D" Basra Survey Party, under the command of Colonel F. W. Pirrie. At any rate a few elevations and depths of water are shown under 1916 dates, though there is nothing to suggest a systematic survey of the area on the surface, as all the data given are for spots easy of access by way of the Tigris canals. A serious shortcoming of this map is that, although by far the greater part of the marshes lies within the Mesopotamian frontier, at least two-thirds of the area is left blank. Be that as it may, the scale of the map is 1 : 253,400 (4 miles to the inch), and it appears to have been printed about April 1917.

Edmonds refers to A. T. Wilson as skirting the marshes "on the east, just in Persia," as a member of the Turco-Persian Boundary Commission of that year. But that scarcely does him justice, as he had prepared himself for the boundary work by extensive exploration, as he tells us ('South-west Persia,' p. 218) in a letter to his parents, dated 28 June 1912: "I am back in Muhammara after three weeks surveying of the quite unknown desert country and *marshes between Ahwaz and 'Amara*, and the desert between Basra and Huwaiza. . . . In the marshes I sometimes waded naked, in the sun, sometimes swam the creeks with men carrying my plane-table and note-books, my dumpy level and staves. Sometimes I went about in a little *mashhuf*, made of reeds, coated with pitch. . . . They are made with very long, tall prows which cleave the reeds, and are poled by half-naked Arabs with long reeds through a maze of narrow passages. . . ." There is no reason to suppose that Wilson reached 'Amara, and he does not tell us how far he got across the marshes in that direction, or record any place visited by him: but there can be no doubt that he did serious survey work in the marsh area and saw the normal life of its inhabitants. He was apparently the

first European to do so! And, during the boundary commission's work, Wilson went with Colonel Ryder (in charge of the survey) from Ahwaz to Kut Saiyid 'Ali on the Karkha river, whence they went in *mashhufs* down the river to Khafajiya and Busaitin, "a town of reed huts built just below water-level, a little ledge of mud sufficing to keep the water from flooding the huts." From here they visited Umm Chir and Thaila by land (?), and went later, by boat, via Makariya and Shammariya to Shuwaiyib, some seventeen miles north-west of Huwaiza, to which Wilson walked *en route* for Ahwaz, while we do not know what Colonel Ryder did after leaving him at Shuwaiyib.

So much for Wilson, who must surely be regarded as the first explorer of the Haur al Huwaiza or Haur al 'Adhim. Edmonds does not mention his companion on the boundary commission, G. E. Hubbard, the author of 'From the Gulf to Ararat,' a popular account of the boundary commission's work. He also visited Busaitin and Umm Chir by *mashhuf*, but his personal experience of the marshes was slight.

Hubbard tells us that in about 1837 Huwaiza was a flourishing town of some 30,000 inhabitants, but that in that year the Karkha river changed its course, with the result that the town "rapidly declined . . . to a tenth of its size" and is now (1914) "little more than a village." The only other fact I know about Huwaiza was recorded in my 'Sa'udi Arabia' (p. 27) as follows: " . . . in 1696 Basra was attacked and captured, possibly with Persian aid and certainly in the Persian interest, by Farajallah ibn Muttalib, the chief of the Marsh Arabs of al Huwaiza. The latter in turn was evicted from the district by the Turks in 1699. . . ."

Another marsh-traveller whom Edmonds ignores is myself! In my 'Arabian days' (pp. 120–1) I wrote a very brief account of my journey by *mashhuf* from 'Amara through the midst of the marshes to Suwaib on the Shatt al 'Arab; and in my 'Forty years in the wilderness' (p. 96) I published one of my photographs of a typical marsh village (Baidha Nawafil).

H. St.J. B. Philby

Riyadh, Saudi Arabia
16 *June* 1958

Mr. C. J. Edmonds writes in reply:

Philby was, of course, one of the "administering political officers" I mention in the review; and the brief references to the marshes in his books must come under "other accounts which a little research would trace." But I am sorry it did not occur to me to look up his various publications, to add to the list. I might perhaps have made more of A. T. Wilson's explorations on the Persian side, or at least given the reference to his 'South-west Persia.' But neither he nor Hubbard (I looked up both) have very much in the way of description of the marshes proper.

Quite a number of us must have notes of journeys similar to Philby's. I still have mine, of a north to south journey through the central marsh in May, 1916—thus seven months before Philby!—as well as of later journeys through all three marshes, which I hope to use one day.

The 1942 map to which I referred is the revised version of the 1917 sheet on the same scale, which Philby describes as "the most interesting of all the maps;" it has much new detail west of the Tigris but, as he correctly guessed, nothing new on the east.

C. J. Edmonds

Heronden,
Hawkhurst, Kent
5 *July* 1958

ARCTIC "VEGETATION ARCS"

Vegetation arcs to which Professor Ross Mackay refers in his letter in the June 1958 issue of the *Journal*, are widespread not only in Arctic and Sub-Arctic Canada but also in northern Europe and Asia. Such patterns cover much larger areas (often many

square miles in extent) than the now well known and curious stone polygons and allied patterned ground features, and their significance both in engineering and geomorphological studies is likely to become far greater. They have been little referred to in English but much more so in German and Russian literature.[1]

A particularly well defined form are the string bogs, or *strängmoore*, which occur notably in eastern Canada, where they provided one of the problems of the terrain traversed by the iron ore railway to Schefferville. They are boggy areas which are characterized by long dykes or banks of somewhat silty material covered with peaty vegetation, which dam up shallow pools. The banks which may stand a metre or more high, are aligned parallel to the contours at intervals of some tens of metres on slopes of probably a degree or less. Their mode of formation is in doubt, although it is probable that thrusting of the ice in the pools during the winter is important. Considerable hydrostatic pressures are reported for the water below the ice in winter.[2] Another possibility is that there is a downslope movement of material by slow flowage, possibly in the frozen state, and which might be similar to the movement of certain forms of solifluction terraces. Considerable disturbance of a peat profile is to be expected where such features occur or have occurred in the past.

They are particularly interesting in that, although covering much of the surface over wide areas, there is a considerable element of climatic control in their distribution. Troll has pointed out in his classic paper[3] that they are restricted to areas with a continental climate of only moderate cold, lying outside the regions of continuous permafrost. Professor Mackay must be referring to somewhat different features, or at least to very localized occurrences, when he refers to those on Cornwallis Island, which is outside the climatic regions associated with string bog formation. There are various structures producing vegetation arcs, as a result of the regular sequence of plant habitats provided by regular terraces or steps on a slope surface. Such features are themselves the result of a variety of processes, but their resemblance to those in Somaliland, or other arid or tropical areas, is surely only superficial.

The abstraction and collection of information on the distribution of precisely described patterned ground features of this type, and on the climatic and other conditions under which they occur would be a most valuable geographic study. Such a project, on a world-wide scale, has recently been proposed by the Periglacial Commission of the International Geographical Union. The information might be related to processes thought to occur in patterned ground formation. It would be an invaluable aid when such features are used in fossil form for study of past climates; it might also cast light on some of the many pitfalls which confront the pleistocene geologist. Geotechnically, a better understanding of such features will allow a more accurate forecast of the conditions for road construction, foundation engineering, etc., that the engineer will meet. The photograph facing p. 127 shows how easily string bogs may be identified from aerial photographs.

P. J. WILLIAMS

National Research Council, Canada,
Division of Building Research,
Ottawa
August 1958

A WATER USE SURVEY

I send the following as a contribution to the discussion of Professor Balchin's paper, published in the *Journal* for December 1958. In the case of certain piped supplies in the Middle East I found the recognition of two simple propositions, with implementation of the second, enabled the population to be satisfied with the

[1] *For example:* Auer, Väino: "Über die Entstehung der Stränge auf Torfmoosen." *Acta for. fenn.*, **12** (1920).

[2] Monaghan, B. M.: Private communication.

[3] Troll, C.: "Struckturböden und Solifluktion." *Geol. Rdsch.*, **34** (1944).

same quantity of water that they had previously found inadequate. Application of the same principles to Great Britain is worth exploring.

1. Alleged water shortage may be due merely to *waste*.
2. Waste is stopped by *metering*.

W. A. MACFADYEN

c/o The Nature Conservancy,
19, Belgrave Square, London, S.W. 1
4 March 1949

MEETINGS: SESSION 1958–9

Meeting of 13 October 1958. Mr. Leonard Brooks in the Chair

Film: They were Kafirs. Colour film with commentary by H.R.H. Prince Peter of Greece

Meeting of 20 October 1958. The President in the Chair

Elections to Fellowship: Richard S. Angold; Rev. Frederick Baillie; Dr. James H. Bird; Mrs. M. J. Butcher; P. B. Chakrabarty; Mrs. Joy Clark; A. F. Collins; John A. Creed; Miss Florence B. Crook; Cyril E. Darlington; John O. Evans; Patrick G. Fitzherbert; George Fryer; Miss Rachel Gibb; Miss Patricia Gillham; D. Hailstone; John R. Hardy; Rev. Reginald M. Harris; Walter W. Herbert; Peter Hickson; Philip R. Hill; Miss Mary K. Hilton; Bryan Holmes; Rev. Walter Hughes; Benjamin C. C. Jansen; E. R. Kellersberger; Mrs. J. Kellersberger; Miss M. Lomas; Maurice K. Lord; Robert M. Mangles; Miss P. A. Miller; James A. Murray; H. R. Natkiel; A. M. Newton; Edet A. U. Nsikak; L. O. J. Onuora; Spencer D. Parker; Miss S. E. Paul; Peter S. Payne; Bernard Pears; Clive H. Pears; Thomas Phelan; Capt. John F. B. Phillips; Edward E. Poodhun; William R. Powell; David L. Pratt; K. V. Rao; Miss Margaret A. Rees; Mrs. Joyce Renton; Ernest G. Sen; Mrs. Katharine Sim; Mrs. Helena M. Smeal; J. C. A. Stokes; Don R. Wijeysuriye; Edmund F. Wilde; Terry Willits; David C. Wilson; Alfred D. J. Wood; J. A. E. Young

Elections to Associate Membership: Miss M. Bradshaw; Miss P. Brown; Miss K. Buck; Miss M. Clark; Viscount Anthony de Fleury; James Denny; Miss R. Edwards; John M. Garrett; Miss M. Grice; G. G. Griffiths; Miss M. E. Griffin; Miss P. M. Nathan; Miss M. M. Newton; Miss D. J. Phillips; Miss M. J. Povey; Miss C. D. Smith; Michael D. Teper

Paper: Exploration in changing Borneo. By Tom Harrisson, O.B.E.

Meeting of 27 October 1958. Dr. K. S. Sandford in the Chair

Paper: Geomorphology of the Tibesti region. By A. T. Grove

Meeting of 3 November 1958. Mr. Leonard Brooks in the Chair

Film: African safari. Colour film with commentary by Lewis Cotlow

Meeting of 10 November 1958. The President in the Chair

Elections to Fellowship: R. H. Cairns; Mrs. Trevor-Cory; Hugh N. Fox; Prof. William R. Geddes; Miss Diana W. Hall; Thomas T. Morris; Douglas A. Tucker; Mrs. Muriel G. M. Tupman

Elections to Associate Membership: Miss C. M. Baker; Miss J. C. Dark; Miss E. W. Davies; Miss A. J. C. Flower; Miss B. Metcalfe; Miss D. J. Mitchenall; Miss L. B. Rees; Miss J. E. Rule; Miss M. Simpson

Paper: South Pole Station. By Dr. Paul A. Siple. Sir James Marshall-Cornwall in the Chair

Meeting of 24 November 1958. Major-General R. Ll. Brown in the Chair

Paper: Hydrographic survey in the Falkland Islands Antarctic Dependencies. By Lieutenant C. J. Wynne-Edwards, R.N.

Meeting of 1 December 1958. Lord Rennell in the Chair

Paper: Saharan survey. By A. R. Akester.

Meeting of 8 December 1958. Mr. Leonard Brooks in the Chair

Films: Journey into spring, and Between the tides

Meeting of 15 December 1958. The President in the Chair

Elections to Fellowship: Roland Allison; Mrs. Arthur Buxton; I. Chipman; John E. B. Finlay; Marshall J. Frost; Mrs. Noeline Hall; Miss Valerie Heatley; David Hicks; Frances J. Iles; Hugh S. Jones; David Kaplan; J. C. Longbotham; Miss Mary McKenna; Edward B. Merriott; Miss J. F. Milnes; Shri Dev Misra; Anthony L. Moore; Flight Lieutenant T. Moore; Peter T. Murphy; Paul Packwood; D. A. Parkins; James B. Rowe; Miss M. A. Shaw; Lewis A. Summersell; Colin J. C. Whimster

Elections to Associate Membership: Bruce W. Atkinson; David P. Davies; Miss G. A. Hibberd; Miss Barbara A. Williams

Paper: Antarctica and the I.G.Y. By Colonel G. R. Laclavère

Meeting of 30 December 1958. The President in the Chair

Joint meeting with the Geographical Association and the Institute of British Geographers

Paper: Antartic snow and its climate. By Dr. Hal Lister

Meeting of 5 January 1959. The President in the Chair

Elections to Fellowship: Mark Anthony; David Barnett; Sidney L. Burke; Mrs. K. F. Caird; J. G. P. Campbell; M. I. Chowdhury; J. L. Cornish; Peter A. Davis; R. F. Disney; Derek C. Ford; Mrs. V. E. Freudenthal; G. C. Geear; A. G. Gooch; Kingsley H. Gregory; Captain R. V. Howell; E. W. Laundon; Mrs. D. Middleton; W. C. Rigby; S. B. Rudge; John Slater; Stanley T. Smith; E. M. Ward; Brian H. Whalley; Bruce Winter; C. T. Quinn-Young

Elections to Associate Membership: R. F. J. Chiplen; J. L. C. R. Smith; Miss Barbara M. Welch

Film: Mr. Leonard Brooks in the Chair. Reclaiming the desert. A Hunting Technical Services sound and colour film about Iraq

Meeting of 12 January 1959. The President in the Chair

Elections to Fellowship: Edward G. Blakeway; C. Broekema; Rear-Admiral K. St. B. Collins; Julien Courtauld; John N. Cunliffe; Miss G. Denegar; Mrs. Ismay C. Emanuel; Michael D. Gwynne; Peter R. Halliwell; John G. R. Harding; Hugh I. Jones; Mrs. K. W. Merrylees; David O. Lort-Phillips; M. Daniel Tatkon; Leslie J. Tresadern

Elections to Associate Membership: Guy D. A. Akins; James P. Bradford; A. A. Forwood

Paper: Climbing in the Caucasus Mountains of the U.S.S.R. By Sir John Hunt, C.B.E., D.S.O.

Meeting of 19 January 1959. Professor E. W. Gilbert in the Chair

Paper: The study of the geography of disease. By Professor A. L. Banks

Meeting of 2 February 1959. The President in the Chair

Elections to Fellowship: Donald Cann, F.I.C.A.; Bryan Foster; David John Fox, M.A., B.SC.; Rev. Robert Bruce Hammond, B.A.; William Arthur Moyes, M.ED.; John Eric Brotnell Potter; Sir John Philip Sargent, C.I.E., D.LITT.; Keith Bowers Spencer; Bryan Unett Dudley Stamp, B.A.; Bernard Stedman, F.R.I.B.A.; Alan Sydney Webster

Elections to Associate Membership: William John Chambers; Sydney C. Duff; Michael Alan Guise; Simon Harrap

Paper: Trans-polar voyage of U.S.S. *Nautilus*. By Dr. Waldo Lyon

Meeting of 9 February 1959. The President in the Chair

Film: Himalayan awakening

THE ROYAL GEOGRAPHICAL SOCIETY

KENSINGTON GORE, LONDON, S.W.7

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The object of the Society being the Promotion and Diffusion of Geographical Knowledge, it has always welcomed to its Fellowship those anxious to further this object by their interest and support, as well as those able to take a more active part in the work of discovery and exploration.

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3. *On attaining the age of 21 Associate Members become eligible for Fellowship. The Entrance Fee of £2 shall be waived provided they have been Associate Members for 3 years. Otherwise Associate Membership shall cease at the age of 21.*

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A pamphlet giving details of the Society and a copy of the Charter and Bye-Laws will be sent on application to the Director and Secretary.

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